

2 X 500 MW NTPC SIPAT STPP, STAGE-II

TECHNICAL SPECIFICATION FOR MISCELLANEOUS FGD TANKS- SITE FABRICATED AND AGITATORS

SPECIFICATION NO.: PE- TS- 491- 167-A001



**BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA**



2X500MW NTPC SIPAT STPP, STAGE-II
TECHNICAL SPECIFICATIONS FOR
MISC. TANKS (SITE FABRICATED) AND
AGITATORS

SPECIFICATION No:PE-TS-491-167-A001

SECTION

DATE

NOV 2022

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**SECTION-I,
SUB-SECTION-A**

INTENT OF SPECIFICATION

	2X500MW NTPC SIPAT STPP, STAGE-II TECHNICAL SPECIFICATIONS FOR MISC. TANKS (SITE FABRICATED) AND AGITATORS	SPECIFICATION No: PE-TS-491-167-A001	
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1.0 INTENT OF SPECIFICATION

- 1.1 The specification covers Supply part, Services part and Mandatory spares for Miscellaneous FGD Tanks and Agitators package, comprising 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, forwarding, proper packing, shipment and delivery at site, erection & commissioning, trial run at site and carrying out Performance guarantee tests at site, training of customer/ client O&M staff covering all aspects of the Agitator - Operation & Maintenance, Troubleshooting etc. & handover in flawless condition of the package to the customer, complete with all accessories cover under scope of work as per BHEL NIT & tender technical specification, amendment & agreements till placement of order of the **MISCELLANEOUS FGD TANKS - SITE FABRICATED AND AGITATORS PACAKGE for 2X500MW SIPAT, STAGE-II FGD PROJECT.**
- 1.2 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 them of the responsibility of providing such facilities to complete the supply, erection and commissioning, performance and guarantee/demonstration testing of MISCELLANEOUS FGD TANKS - SITE FABRICATED AND AGITATORS PAKCAGE.
- 1.3 It is not the intent to specify herein all the details of design and manufacture. However, the equipment / system shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in Customers judgement is not in full accordance herewith.
- 1.4 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 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.
- 1.5 Items though not specifically mentioned but needed to make the system complete as stipulated under these specifications are also to be furnished unless otherwise specifically excluded.
- 1.6 The general terms and conditions, instructions to tenderer and other attachment referred to elsewhere are hereby made part of the tender specifications. The equipment / material and works covered by this specification is subject to compliance to all the attachments referred in the specification. The tenderer shall be responsible for adherence to all requirements stipulated herein.

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1.7	<p>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 Sec.-III of the specification within 10 days of receipt of tender documents. In absence of any such clarifications, 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.</p>		
1.8	<p>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.</p>		
1.9	<p>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.</p>		
1.10	<p>In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.</p>		
1.11	<p>Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder/vendor and Customer/Purchaser/Employer will mean BHEL and/or Customer as interpreted by BHEL in the relevant context. Please refer GCC/SCC for better clarity.</p>		
1.12	<p>Various codes and standards to be used shall be as indicated in various parts of the specification. In case bidder uses any standard other than those indicated in the specification, the onus of establishing equivalence of the same with the specified standards will rest with the bidder and acceptance of the same shall be sole prerogative of customer.</p>		
1.13	<p>All text/ numeric in the document / drawings to be generated by the successful bidder will be in English language only.</p>		
1.14	<p>The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.</p>		

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**PROJECT INFORMATION WITH WIND AND
SEISMIC DESIGN CRITERIA**

CLAUSE NO.	PROJECT INFORMATION		
1.00.00	<p>BACKGROUND</p> <p>Sipat Super Thermal Power Project (Coal Based) stage-II (2X500MW) is set up in the state of Chhattisgarh, located near Sipat in Bilaspur district. The capacity of the project in Stage-II is 1000 MW comprising of 2 x 500 MW units and the ultimate capacity of the project is 2980 MW (3X660 + 2X500 MW).</p>		
1.01.00	<p>LOCATION AND APPROACH</p> <p>The site is located east of the Kurung left bank canal and is bounded by villages Rank, Kaudia and Janji in the Bilaspur district of Chhattisgarh. It is in between latitudes 22°05' & 22°09' North and longitudes 82° 16' & 82° 18' East. The site is approx. 20 kms. from Bilaspur city and is approachable via the Bilaspur - Sipat state highway which takes off to the North-East from Bilaspur City. The nearest railway station is Jairamnagar on the Nagpur-Raipur-Calcutta mainline. Raipur, which is approximately 140 kms. from the site is the nearest commercial airport.</p>		
1.02.00	<p>LAND REQUIREMENT</p> <p>Land required for the ultimate stage of project i.e. 2980 MW is acquired.</p>		
1.03.00	<p>WATER</p> <p>The water requirement for the ultimate stage of the project is 120 million cubic meter/ annum. Source/ arrangement to meet water requirement is from Hasdeo Barrage Right Bank Canal (RBC) has been accorded by MP Water Resource Deptt. CWC has also concurred for 120 MCM drawal, sufficient for Stage-I & Stage-II of the project.</p> <p>Water is drawn from the RBC, originated from Hasdeo Barrage pond, at chainage 37.95 km. nearest to Sipat STPP. One month's in-plant storage reservoir is provided for meeting the water requirement during the canal closure period.</p>		
1.04.00	<p>COAL AVAILABILITY AND TRANSPORTATION</p> <p>Coal Availability</p> <p>SLC (LT) had accorded long term linkage of 10 million tonne / year.</p> <p>Coal Transportation</p> <p>Coal is being transported through merry-go-round system.</p> <p>Coal Quality Parameters / Fuel Oil Characteristics</p> <p>The coal quality parameters and ash characteristics/parameters (Table-1, Annexure-BI) and Fuel oil Characteristics (Table-2A & 2B, AnnexureBI) is attached under this sub-section.</p>		
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-0011-109-(6)2	SUB-SECTION-II A3 PROJECT INFORMATION SIPAT STPP-II (2X500 MW)	PAGE 1 OF 24


CLAUSE NO.	PROJECT INFORMATION		
1.05.00	Steam Generator and ESP data: refer Table-3		
1.06.00	Plant Water details: (i) FGD Process water/CW blow down water quality is indicated in Table-4. (ii) Clarified water quality is indicated in Table-5. (iii) DM water quality is indicated in Table-5A		
2.00.00	NOT USED		
3.00.00	NOT USED		
4.00.00	METEOROLOGICAL DATA Important meteorological data from nearest observatory at Champa is placed at ANNEXURE- AI.		
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 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:		
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-0011-109-(6)2	SUB-SECTION-II A3 PROJECT INFORMATION SIPAT STPP-II (2X500 MW)	PAGE 2 OF 24


CLAUSE NO.	PROJECT INFORMATION									
	<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> <p>Method of Analysis</p> <p>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).</p> <p>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).</p> <p>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.</p> <p>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.</p> <p>Design/Detailing for Ductility for Structures</p> <p>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.</p>	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%									
<p>LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-0011-109-(6)2</p>	<p>SUB-SECTION-II A3 PROJECT INFORMATION SIPAT STPP-II (2X500 MW)</p>	<p>PAGE 3 OF 24</p>							


CLAUSE NO.	PROJECT INFORMATION	
	<p style="text-align: right;"><u>ANNEXURE – I</u></p> <p><u>SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT</u></p> <p>The various site specific seismic parameters for the project site shall be as follows:</p> <ol style="list-style-type: none"> 1) Peak ground horizontal acceleration : 0.14g 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 <ol style="list-style-type: none"> a) for special moment resisting steel frames designed and detailed as per IS:800 : 0.035 b) For special concentrically braced steel frames designed and detailed as per IS:800 : 0.026 c) for special moment resisting RC frames designed and detailed as per IS:456 and IS:13920 : 0.021 d) for RCC chimney : 0.07 e) For Liquid retaining tanks : 0.042 f) for Steel chimney, Absorber tower, Vessels : 0.053 g) for design of structures not covered under 2 (a) to 2 (f) above and under 3 below, in general (excluding special structure/configuration/materials) : 0.035 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 : 0.07 <p>Note:</p> <ol style="list-style-type: none"> 1. g = Acceleration due to gravity 2. For industrial structures, analysis for verification of mechanism shall be carried out as per IS:1893 (Part 4):2015 <p>The horizontal seismic acceleration spectral coefficients are furnished in subsequent pages.</p>	
<p style="text-align: center;">LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p style="text-align: center;">TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-0011-109-(6)2</p>	<p style="text-align: center;">SUB-SECTION-II A3 PROJECT INFORMATION SIPAT STPP-II (2X500 MW)</p> <p style="text-align: right;">PAGE 4 OF 24</p>


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	<u>ANNEXURE – I</u>						
	<u>HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS</u>						
	<u>In units of 'g' for SIPAT STPP</u>						
	Period (Sec)	Damping Factor (as a percentage of critical damping)					
		0.80%	1%	1.60%	2%	3%	5%
	.04	0.9914	0.9877	0.9867	0.9859	0.9849	0.9839
	.05	1.2262	1.1579	1.1467	1.1392	1.1299	1.1009
	.06	1.4516	1.3487	1.3272	1.3104	1.2892	1.2449
	.07	1.8388	1.6845	1.6345	1.5944	1.5666	1.5076
	.08	2.3009	2.1316	2.0801	1.9571	1.8387	1.7396
	.09	3.6683	3.3390	2.9378	2.6591	2.1409	1.9978
	.10	4.5596	3.8254	3.3886	3.1526	2.4177	2.1830
	.12	5.1376	4.4231	3.9292	3.6907	2.8694	2.4421
	.14	5.4416	4.7467	4.2463	4.0499	3.2878	2.6563
	.16	5.6857	5.0086	4.4829	4.2566	3.4812	2.8190
	.18	5.8457	5.2097	4.6616	4.4118	3.5682	2.8920
	.20	5.8971	5.3013	4.7794	4.5035	3.5972	2.9322
	.22	5.9439	5.3612	4.8599	4.5652	3.6281	2.9490
	.24	5.9729	5.3977	4.9076	4.5942	3.6383	2.9528
	.26	5.9860	5.4369	4.9319	4.5793	3.6299	2.9406
	.28	5.9850	5.4398	4.9291	4.5540	3.6028	2.9172
	.30	5.9579	5.4239	4.8917	4.4231	3.5308	2.8770
	.40	5.4248	4.7794	4.1453	3.5701	2.9584	2.5122
	.50	3.8946	3.6309	3.1978	2.8761	2.4290	2.0867
	.60	3.1651	3.0098	2.6638	2.4215	2.0334	1.7509
	.70	2.6956	2.5674	2.3270	2.0885	1.7378	1.4899
	.80	2.3345	2.2232	2.0418	1.8510	1.5498	1.3300
	.90	2.0633	1.9548	1.8407	1.6892	1.4366	1.2224
	1.00	1.8884	1.7874	1.6957	1.5844	1.3590	1.1532
	1.10	1.7602	1.6695	1.5825	1.4899	1.2851	1.1037
	1.20	1.6518	1.5564	1.4825	1.3955	1.2103	1.0503
	1.30	1.5498	1.4619	1.3908	1.3104	1.1467	1.0148
	1.40	1.4600	1.3730	1.3048	1.2281	1.0896	.9746
	1.50	1.3693	1.2917	1.2281	1.1551	1.0373	.9344
	1.60	1.2935	1.2112	1.1532	1.0887	.9821	.8923
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-0011-109-(6)2	SUB-SECTION-II A3 PROJECT INFORMATION SIPAT STPP-II (2X500 MW)	PAGE 5 OF 24				


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6.00.00	<u>ANNEXURE – I</u>							
	<u>HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS</u> <u>In units of 'g' for SIPAT STPP</u>							
	Period (Sec)	Damping Factor (as a percentage of critical damping)						
		0.80%	1%	1.60%	2%	3%	5%	
	1.70	1.2178	1.1411	1.0887	1.0176	.9372	.8549	
	1.80	1.1514	1.0812	1.0242	.9587	.8885	.8165	
	1.90	1.0850	1.0111	.9606	.9044	.8455	.7782	
	2.00	1.0204	.9549	.9072	.8567	.7969	.7426	
	2.10	.9690	.8988	.8577	.8118	.7482	.6996	
	2.20	.9185	.8511	.8147	.7772	.7062	.6519	
	2.30	.8801	.8109	.7810	.7389	.6669	.6154	
	2.40	.8455	.7782	.7473	.7090	.6285	.5771	
	2.50	.8090	.7445	.7155	.6744	.5995	.5387	
	2.75	.7333	.6706	.6407	.6014	.5341	.4536	
	3.00	.6566	.6061	.5808	.5406	.4714	.3910	
	3.25	.5920	.5509	.5210	.4798	.4162	.3535	
	3.50	.5369	.4976	.4705	.4302	.3732	.3227	
	3.75	.4910	.4602	.4312	.3910	.3311	.2956	
	4.00	.4536	.4228	.3966	.3564	.3012	.2750	
	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 – C1 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.								
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-0011-109-(6)2	SUB-SECTION-II A3 PROJECT INFORMATION SIPAT STPP-II (2X500 MW)	PAGE 6 OF 24					


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	<p>Susceptibility of structures to across-wind forces, galloping, flutter, ovalling etc. should be examined and designed/detailed accordingly following the recommendations of IS:875(Part-3) and other relevant Indian standards.</p> <p>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.</p> <p>Damping in Structures</p> <p>The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for:</p> <p>a) Welded steel structures : 1.0%</p> <p>b) Bolted steel structures : 2.0%</p> <p>c) Reinforced concrete structures : 1.6%</p> <p>d) Steel stacks : As per IS:6533 & CICIND Model Code whichever is more critical.</p>			
<p align="center">LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-0011-109-(6)2</p>	<p align="center">SUB-SECTION-II A3 PROJECT INFORMATION SIPAT STPP-II (2X500 MW)</p>	<p align="center">PAGE 7 OF 24</p>	


CLAUSE NO.	PROJECT INFORMATION			
	<p style="text-align: right;"><u>ANNEXURE-C1</u></p> <p><u>SITE SPECIFIC DESIGN PARAMETERS</u></p> <p>The various design parameters, as defined in IS: 875 (Part-3), to be adopted for the project site shall be as follows:</p> <p>a) The basic wind speed “V_b” at ten metres above the mean ground level : 45 metres/second</p> <p>b) The risk coefficient “K_1” : 1.07</p> <p>c) Category of terrain : Category-2</p> <p>7.00.0 FOUNDATION SYSTEM AND GEOTECHNICAL DATA</p> <p>7.01.0 Soil Data</p> <p>Owner has carried out geotechnical investigation in the proposed area of Sipat STPP. Bearing capacity for design of foundations and Bore logs data are given at Annexure – C2 of this specification. The geotechnical investigation report comprising of Boreholes, Laboratory tests, Chemical analysis, etc. in respect of the sub-strata prevailing at site will be made available for the Bidder's study at the Employer's office, if required. The onus of correct assessment / interpretation and understanding of the existing subsoil condition / data is on the Bidder. In case, bidder feels that the available data is inadequate, he may carry out his own geotechnical investigation. Geotechnical Investigation layout/location of borehole/field test where investigation has been carried out and is enclosed as Annexure-C3. Further, if any change in layout or area not covered as per enclosed Geotechnical Investigation layout, Contractor shall carry out geotechnical investigation in the area at no cost to owner. The scheme for geotechnical investigation shall be approved by owner before execution. Geotechnical investigation work shall got executed by the Contractor through the agencies as mentioned in Clause No. 7.07.00. 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.</p> <p>Site levelling & grading had been carried out and achieved finished ground level (FGL). Bidder may refer topographical survey drawing for variation in existing/ natural ground level (NGL) and FGL.</p> <p>Ground water table is varying from 2.0m to 5.0m at the time of geotechnical investigation and may fluctuate with seasonal variation</p> <p>7.01.01 The furnished borelog details are specific to the co-ordinates where the boreholes have been carried out and are provided for bidder's information only. Soil profile in the proposed area may vary with respect to the borelogs enclosed for bidder's information. Bidder has to consider all such variations in his estimation, over the extent of the work to be carried out. The Bidder should note that nothing extra whatsoever on account of variation between soil data collected by Owner and that</p>			
<p style="text-align: center;">LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p style="text-align: center;">TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-0011-109-(6)2</p>	<p style="text-align: center;">SUB-SECTION-II A3 PROJECT INFORMATION SIPAT STPP-II (2X500 MW)</p>	<p style="text-align: center;">PAGE 8 OF 24</p>	


CLAUSE NO.	PROJECT INFORMATION		
7.01.02	<p>found by the Bidder during geotechnical investigation by him or during execution of works, shall be Payable.</p> <p>Tank Foundations</p> <ol style="list-style-type: none"> 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. 		
7.02.00	<p>Foundation System</p> <p>The requirements for the foundation system to be adopted are as given in subsequent clauses.</p>		
7.02.01	<p>General Requirements</p> <ol style="list-style-type: none"> a) All structures/equipment shall be supported on suitable open foundations (isolated, combined, raft) 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. If the encountered sub-strata is black cotton soil, the same shall be either replaced upto the full depth or black cotton soil shall be stabilized by suitable treatment. c) No other foundation (other than as mentioned in (b) above and (i) below) shall rest on the filled up ground / soil. d) 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. e) 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. If required bidder may carry out GPR survey to locate existing underground facilities at no extra cost to owner. f) All foundations shall be designed in accordance with relevant parts of the latest revisions of Indian Standards. 		
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-0011-109-(6)2	SUB-SECTION-II A3 PROJECT INFORMATION SIPAT STPP-II (2X500 MW)	PAGE 9 OF 24

CLAUSE NO.	PROJECT INFORMATION		
7.02.02	<p>g) The water table for design purpose shall be considered at Finished Ground Level.</p> <p>h) A combination of open and pile foundations shall not be permitted under the same equipment / structure / building.</p> <p>i) Foundation for equipment on ground floor</p> <p>For equipment 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.</p> <p>For equipment's of static weight between 1.5 T and 20 T, the equipment may be supported on compacted sand filling with the load intensity below the equipment limited to 4T/m². The minimum depth of foundation is 1.0m below FFL. Other requirements of sand compaction below the foundation shall be adhered, as specified elsewhere in the specifications.</p> <p>For equipment of static weight more than 20 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 Annexure C2 -Table 2. 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.</p> <p>Open Foundations</p> <p>In case open foundations are adopted, following shall be adhered to.</p> <p>a) The minimum width of foundation shall be 1.0 m.</p> <p>b) Minimum depth of foundation shall be 1.0m below Ground Level.</p> <p>c) It shall be ensured that all foundations of a particular structure/ buildings/ facility shall rest on one bearing stratum.</p> <p>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.</p> <p>e) Wherever the intended bearing stratum is weathered rock, but the actual strata encountered during excavation consists of both overburden soil and weathered rock at founding level, under such cases, the overburden upto the weathered rock level including 0.5 m into the weathered rock shall be removed and built up through PCC (1:3:6) upto the designed founding level. Thus, maintaining the same founding level for all the footings of a structure. The treatment at the base of foundation before laying the PCC shall be carried out as per IS: 12070.</p>		
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-0011-109-(6)2	SUB-SECTION-II A3 PROJECT INFORMATION SIPAT STPP-II (2X500 MW)	PAGE 10 OF 24

CLAUSE NO.	PROJECT INFORMATION		
	<p>f) The last layer of about 300 mm before reaching the founding level shall be excavated carefully by such equipment so that soil / rock at the required level will be left in its natural condition.</p> <p>g) If joints, fissures or other discontinuities in rock are encountered at founding level, then treatment of such rock defects shall be carried out as per IS: 13063-1991 in consultation with the Engineer.</p>		
7.03.00	<p>Special Requirements</p> <p>Details of treatment for foundations / underground structures required to counteract soil / water chemical environment, cement type, grade of concrete, type of reinforcement, cover to reinforcement and protective coating to foundations, etc. shall be as mentioned in Annexure-C2 of this specification.</p>		
7.04.00	Excavation, Filling and Dewatering		
7.04.01	<p>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.</p>		
7.04.02	<p>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.</p>		
7.04.03	<p>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. In any case, black cotton soil shall not be used in back filling without providing cushion of 1m of non expansive cohesive soil/moorum around the footings. In case of roads in the area of black cotton soil, minimum 0.4m moorum shall be provided.</p> <p>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.</p>		
7.04.04	<p>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.</p>		
7.04.05	<p>CBR tests for pavement/road design shall be carried out by the Contractor after earth filling (if applicable) has been completed up to the formation level.</p>		
7.04.06	<p>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.</p> <p>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.</p>		
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-0011-109-(6)2	SUB-SECTION-II A3 PROJECT INFORMATION SIPAT STPP-II (2X500 MW)	PAGE 11 OF 24

CLAUSE NO.	PROJECT INFORMATION			
<p>7.05.00</p> <p>EXCAVATION IN ROCK</p> <p>7.05.01</p> <p>7.05.02 (a)</p> <p>7.06.00</p> <p>Sheeting & Shoring</p> <p>7.07.00.00</p>	<p>No worker should be allowed to work where he may be stuck or endangered by excavation machinery or collapse of excavations or trenches.</p> <p>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.</p> <p>Controlled blasting shall be done by a specialized agency duly approved by Engineer. All controlled blasting shall be done by using time delay detonators (i.e. excel type).</p> <p>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 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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>Geotechnical investigation work shall be got executed by the Contractor through the following agencies.</p> <ol style="list-style-type: none"> 1. C.E.TESTING COMPANY Pvt. Ltd, Kolkata 2. Cengrs Geotechnica Pvt. Ltd, New Delhi 3. KCT Consultancy Services, Ahemdabad 4. M.K. Soil Testing Laboratory, Ahemdabad 			
<p align="center">LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION-VI</p> <p align="center">BID DOC NO.: CS-0011-109-(6)2</p>	<p align="center">SUB-SECTION-II A3 PROJECT INFORMATION SIPAT STPP-II (2X500 MW)</p>	<p align="center">PAGE 12 OF 24</p>	

CLAUSE NO.	PROJECT INFORMATION																																										
	Annexure-C2																																										
SOIL DATA AND FOUNDATION SYSTEM	SOIL DATA AND FOUNDATION SYSTEM																																										
	Employer has carried out geotechnical investigation in the proposed area. Logs of boreholes of proposed area are enclosed separately as Annexure-C4 .																																										
a)	The foundation system to be adopted for different structures shall be as given in Table – 1 below																																										
	Table – 1:																																										
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 70%; text-align: center;">STRUCTURE</th> <th style="text-align: center;">TYPE OF FOUNDATION TO BE ADOPTED</th> </tr> </thead> <tbody> <tr> <td>Chimney, Absorber, LHP, GHP area structures, FGD control room building and other structures</td> <td style="text-align: center;">Open</td> </tr> </tbody> </table>			STRUCTURE	TYPE OF FOUNDATION TO BE ADOPTED	Chimney, Absorber, LHP, GHP area structures, FGD control room building and other structures	Open																																				
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b)	The minimum founding level and the corresponding net allowable bearing pressure shall be as given in Table – 2 below.																																										
	Table – 2: Net Allowable Bearing Pressure																																										
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="width: 45%;">Founding Depth/ Stratum</th> <th colspan="3" style="text-align: center;">Net Allowable Bearing Pressure T/m²</th> </tr> <tr> <th style="width: 20%;">Isolated footings for permissible settlement in case of soil and 12mm in case of rocky strata</th> <th style="width: 20%;">and combined footings for 40mm permissible settlement in case of soil and 12mm in case of rocky strata</th> <th style="width: 15%;">Rafts (width > 6m) for 75mm permissible settlement in case of soil and 12mm in case of rocky strata</th> </tr> </thead> <tbody> <tr> <td></td> <td colspan="3" style="text-align: center;">Width upto 6.0m</td> </tr> <tr> <td colspan="4" style="text-align: center;">In case of Soil</td> </tr> <tr> <td>1.0m below NGL</td> <td style="text-align: center;">12</td> <td style="text-align: center;">12</td> <td style="text-align: center;">12</td> </tr> <tr> <td>2.0m below NGL</td> <td style="text-align: center;">15</td> <td style="text-align: center;">15</td> <td style="text-align: center;">15</td> </tr> <tr> <td colspan="4" style="text-align: center;">In case of rocky strata</td> </tr> <tr> <td>0.30m Embedment in Fine grained weathered sand stone / Mud stone.</td> <td style="text-align: center;">30</td> <td style="text-align: center;">30</td> <td style="text-align: center;">30</td> </tr> <tr> <td>0.6m Embedment in Fine grained weathered sand stone / Mud stone.</td> <td style="text-align: center;">40</td> <td style="text-align: center;">40</td> <td style="text-align: center;">40</td> </tr> <tr> <td>1.0m Embedment in Fine grained weathered sand stone / Mud stone.</td> <td style="text-align: center;">50</td> <td style="text-align: center;">50</td> <td style="text-align: center;">50</td> </tr> </tbody> </table>			Founding Depth/ Stratum	Net Allowable Bearing Pressure T/m ²			Isolated footings for permissible settlement in case of soil and 12mm in case of rocky strata	and combined footings for 40mm permissible settlement in case of soil and 12mm in case of rocky strata	Rafts (width > 6m) for 75mm permissible settlement in case of soil and 12mm in case of rocky strata		Width upto 6.0m			In case of Soil				1.0m below NGL	12	12	12	2.0m below NGL	15	15	15	In case of rocky strata				0.30m Embedment in Fine grained weathered sand stone / Mud stone.	30	30	30	0.6m Embedment in Fine grained weathered sand stone / Mud stone.	40	40	40	1.0m Embedment in Fine grained weathered sand stone / Mud stone.	50	50	50	
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CLAUSE NO.	PROJECT INFORMATION									
	<p>For NGL, topographical survey drawing along with borehole details shall be referred.</p> <p>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.</p> <p>In case any loose/soft pockets in rocky strata is encountered at founding level, the same shall be removed completely upto the hard strata and filled up with PCC (1:4:8).</p> <p>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:</p> <table border="1"> <tbody> <tr> <td>Isolated & Strip</td> <td>40 mm</td> </tr> <tr> <td>Raft (widths greater than 6 m)</td> <td>75 mm</td> </tr> <tr> <td>Foundations in rock</td> <td>12 mm</td> </tr> </tbody> </table> <p>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.</p>			Isolated & Strip	40 mm	Raft (widths greater than 6 m)	75 mm	Foundations in rock	12 mm	
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Raft (widths greater than 6 m)	75 mm									
Foundations in rock	12 mm									
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PROJECT INFORMATION



ANNEXURE-AI

जलवायवी सारणी
CLIMATOLOGICAL TABLE

1951 से 1980 तक के अवधि पर आधारित
BASED ON OBSERVATIONS FROM 1951 TO 1980

स्थान: चम्पा
STATION: Champa
LAT 22°02' N LONG 82°42' E
ऊँचाई: 245 METRES
HEIGHT ABOVE M. S. L.

वर्ष	वायु तापमान				वायु				अर्ध				वर्ष				वर्ष					
	DRY BULB	WET BULB	DAILY MAX	DAILY MIN	HIGHEST MONTH	LOWEST MONTH	HIGHEST YEAR	LOWEST YEAR	DATE HIGHEST	DATE LOWEST	सर्वाधिक तापमान	सर्वाधिक अर्ध	सर्वाधिक वर्ष	सर्वाधिक वर्ष	सर्वाधिक वर्ष	सर्वाधिक वर्ष	सर्वाधिक वर्ष	सर्वाधिक वर्ष				
MONTH	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C				
जनवरी	15.8	12.7	27.2	13.0	30.3	9.0	32.6	28	6.2	22	1963	67	12.1	1.9	14.9	1.1	78.2	0.0	64.0	06	1945	
फरवरी	15.0	12.9	27.2	13.0	30.3	9.0	32.6	28	6.2	22	1963	35	12.6	2.1	14.9	1.1	78.2	0.0	64.0	06	1945	
मार्च	19.2	17.8	30.7	15.6	35.0	10.8	37.5	29	8.3	08	1977	57	12.8	1.8	13.8	1.3	67.2	0.0	43.6	01	1961	
अप्रैल	24.2	18.7	35.5	19.6	40.0	15.1	42.4	30	11.5	1965	23	11.1	2.5	21.3	1.9	156.0	0.0	86.1	20	1951		
मई	33.6	19.5	40.2	24.4	43.9	20.0	46.9	28	18.1	02	1965	38	15.3	0.7	15.0	1.4	80.0	0.0	37.8	29	1956	
जून	38.3	21.5	42.7	27.9	45.9	23.2	48.0	23	19.9	01	1978	20	14.0	3.8	15.0	1.4	80.0	0.0	37.8	29	1956	
जुलाई	40.1	24.4	48.2	27.0	44.3	22.8	47.2	03	20.4	09	1971	48	23.8	6.6	17.1	8.5	47.0	48.4	154.8	25	1968	
अगस्त	34.9	24.9	42.4	24.5	35.8	22.4	39.4	1964	20.4	1965	87	29.9	7.2	8.0	390.1	17.7	877.1	218.8	347.2	26	1947	
सितम्बर	28.5	25.7	31.3	24.5	35.8	22.4	37.4	01	21.5	1964	78	30.3	7.4	5.9	434.8	17.1	790.5	1965	200.4	11	1963	
अक्टूबर	26.3	24.8	30.7	24.5	34.1	22.6	37.4	1972	21.5	1964	79	30.3	7.2	6.1	434.8	17.1	790.5	1965	200.4	11	1963	
नवम्बर	24.7	24.7	31.6	24.3	34.3	22.3	36.0	11	19.8	29	1968	85	29.6	6.4	22.7	11.4	535.4	55.5	199.0	23	1959	
दिसम्बर	21.9	23.2	31.7	21.4	34.1	17.3	36.2	12	15.3	30	1974	79	24.4	3.0	45.1	3.3	258.1	0.0	100.2	01	1973	
जनवरी	20.9	23.2	29.7	16.4	32.0	12.8	35.1	1977	9.6	1980	71	18.5	2.1	0.4	4.5	0.4	47.5	0.0	41.1	30	1946	
फरवरी	25.8	19.2	29.7	16.4	32.0	12.8	35.1	1979	9.6	1980	71	18.5	2.1	0.4	4.5	0.4	47.5	0.0	41.1	30	1946	
मार्च	16.0	13.1	27.3	13.0	29.9	9.7	32.1	01	6.9	30	1969	44	13.5	1.2	0.3	5.6	0.3	55.6	0.0	45.4	11	1967
अप्रैल	24.5	17.0	33.1	21.0	46.1	8.5	48.0	66	20.1	3.6	1.9	66	20.1	3.6	1.9	1354.1	65.5	2134.1	856.3	347.2	5.8	
मई	30.8	21.7	30	30	30	30	36	47	19.1	4.2	2.2	47	19.1	4.2	2.2	1961	1979	36	36	36	30	
जून	30	30	30	30	30	30	36	30	30	30	24	30	30	24	30	30	36	36	36	36	30	
जुलाई	30	30	30	30	30	30	36	30	30	30	24	30	30	24	30	30	36	36	36	36	30	
अगस्त	30	30	30	30	30	30	36	30	30	30	24	30	30	24	30	30	36	36	36	36	30	
सितम्बर	30	30	30	30	30	30	36	30	30	30	24	30	30	24	30	30	36	36	36	36	30	
दिसम्बर	30	30	30	30	30	30	36	30	30	30	24	30	30	24	30	30	36	36	36	36	30	
कुल औसत	24.3	19.7	33.1	21.0	46.1	8.5	48.0	66	20.1	3.6	1.9	66	20.1	3.6	1.9	1354.1	65.5	2134.1	856.3	347.2	5.8	
कुल औसत	30.8	21.7	30	30	30	30	36	47	19.1	4.2	2.2	47	19.1	4.2	2.2	1961	1979	36	36	36	30	
कुल औसत	30	30	30	30	30	30	36	30	30	30	24	30	30	24	30	30	36	36	36	36	30	


CLAUSE NO.


PROJECT INFORMATION




जलवायु की सारणी
CLIMATOLOGICAL TABLE


MONTH	PPT OF MORE		HAUL		TALLEN DER		FOG		DUST STORM		SOU ALL		No. OF DAYS WITH WIND SPEED (Km. P. H.)		PERCENTAGE No. OF DAYS WIND FROM		No. OF DAYS WITH CLOUD AMOUNT (O.K.T.A.S)		No. OF DAYS WITH LOW CLOUD AMOUNT (O.K.T.A.S)		No. OF DAYS WITH VISIBILITY		
	1.5	2.0	3.2	4.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
JAN	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
FEB	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
MAR	3.2	0.1	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
APR	2.4	0.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
MAY	2.0	0.0	4.8	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
JUN	12.0	0.0	10.7	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
JUL	22.7	0.0	9.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
AUG	22.1	0.0	10.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
SEP	15.0	0.0	8.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
OCT	4.9	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
NOV	0.8	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
DEC	0.8	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
TOTAL	89.5	0.1	57.0	0.1	4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
MEAN																							
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CLAUSE NO.	PROJECT INFORMATION						
ANNEXURE-B I							
TABLE – 1							
COAL CHARACTERISTICS*							
Sl. No.	Description	Symbol	Design Coal	Worst Coal	Best Coal	Range of Adequacy Coal	
1	2 PROXIMATE ANALYSIS (As received basis)	3	4	5	6	7	
1.	Total Moisture	%	13.00	15.00	11.00	10.00-16.00	
2.	Ash	%	40.00	45.00	33.00	29.00-47.00	
3.	Volatile matter	%	22.00	20.00	24.00	26.00-17.00	
4.	Fixed carbon	%	25.00	20.00	32.00	35.00-20.00	
B.	ULTIMATE ANALYSIS (As received basis)						
1.	Carbon	C%	33.36	29.40	42.05	46.85-27.8	
2.	Hydrogen	H2%	3.10	2.3	3.2	2.8-3.3	
3.	Nitrogen	N2%	1.50	0.5	1.53	.4-0-1.8	
4.	Oxygen (By difference)	O2%	7.8	6.27	7.93	5.5-7.35	
5.	Sulphur	S%	0.4	0.5	0.35	0.30-0.50	
6.	Carbonates	CO3%	0.80	0.5	0.90	0.35-1.1	
7.	Phosphorous	P2%	0.10	0.15	0.05	0.1-0.3	
8.	Total Moisture	H2O%	13.00	15.00	11.00	10.00-16.00	
9.	Ash	%	40.00	45.00	33.00	29.00-47.00	
10.	Gross Calorific Value	KCal/Kg	3300	2800	4000	3000-4600	
11.	Hard grove index		55	45	55	45-65	
C.	ASH ANALYSIS						
1.	Silica	(SiO2)%	58.85	59.00	58.2	59.9-58.2	
2.	Alumina	(Al2O3)%	28.8	28.00	29.5	27.7-30	
3.	Iron Oxide	(Fe2O3)	5.5	6.00	4.7	4.5-6.5	
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-0011-109-(6)2	SUB-SECTION-II A3 PROJECT INFORMATION SIPAT STPP-II (2X500 MW)	PAGE 17 OF 24				


CLAUSE NO.	PROJECT INFORMATION							
	Sl. No.	Description	Symbol	Design Coal	Worst Coal	Best Coal	Range of Adequacy Coal	
	1	2	3 %	4	5	6	7	
	4.	Titania	(TiO ₂)%	1.8	2	1.7	1.5-2.1	
	5.	Phosphoric Anhydride	(P ₂ O ₅)%	.7	.6	.9	.4- .95	
	6.	Lime	(CaO)%	1.5	1.2	1.9	1.0-2.1	
	7.	Magnesia	(MgO)%	1.3	1.5	1.2	1-1.8	
	8.	Sulphuric Anhydride	(SO ₃)%	.5	.6	.4	.6 - .4	
	9.	Alkalies (By Difference)	(Na ₂ O+K ₂ O)%	1.15	1.02	1.2	09-1.2	
	Note: Na ₂ O content in the above shall not be more than 0.1%							
	D.	ASH FUSION RANGE (Under reducing atmosphere)						
	a)	Initial Deformation Temperature (IDT)	°C	1150	1100	1200	1100-1200	
	b)	Hemispherical temperature	°C	1350	1300	1400	1300-1400	
	c)	Flow temperature	°C	1400	1350	1400	1350-1400	
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-0011-109-(6)2	SUB-SECTION-II A3 PROJECT INFORMATION SIPAT STPP-II (2X500 MW)	PAGE 18 OF 24					

CLAUSE NO.	PROJECT INFORMATION				
TABLE – 2A					
<u>FUEL OIL CHARACTERISTICS</u>					
Sl. No.	Characteristics	Heavy Furnace Oil grade HV (HFO) IS-1593-1982	Low Sulphur Heavy Stock (LSHS) IS-11489-1985	Heavy Petroleum stock (HPS) IS-11489-1985	
1.	Total sulphur content	4.5% Max.	1.0% Max.	4.5% Max.	
2.	Gross calorific value (KCal/kg)	of the order of 10,000	of the order of 10,000	of the order of 10,000	
3.	Flash Point (Min)	66 deg C	76 deg C	66 deg C	
4.	Water content by volume (Max)	1.0%	1.0%	1.0%	
5.	Sediment by weight (Max)		0.25%	0.25% 0.25%	
6.	Asphaltene content by weight (Max.)	2.5%	2.5%	2.5%	
7.	Kinematic viscosity in Centistokes	370 at 50deg C	100 at 100deg C	100 at 100deg C	
8.	Ash Content by weight (Max.)	0.1%	0.1%	0.1%	
9.	Acidity (inorganic)	Nil	Nil	Nil	
10.	Pour Point (Max.)	57 deg C	66 deg C	72 deg C	
11.	Sodium content	—	—	100 ppm	
12.	Vanadium content	25 ppm	25ppm	25 ppm	
13.	Specific heat below pour point (KCal/Kg °C)		0.65		


LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-0011-109-(6)2	SUB-SECTION-II A3 PROJECT INFORMATION SIPAT STPP-II (2X500 MW)	PAGE 19 OF 24
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CLAUSE NO.	PROJECT INFORMATION		
	LIGHT DIESEL OIL CHARACTERISTICS AS PER IS 1460-2000		TABLE – 2B
	Characteristics	LDO	
	1. Pour Point (max)	21 deg.C & 12°C for Summer and Winter respectively	
	2. Kinematic viscosity in centistokes at 40 deg.C	2.5 to 15.7	
	3. Sediment percent by mass (max)	0.10	
	4. Total sulphur percent by mass (max)	1.8	
	5. Ash percentage by mass (max)	0.02	
	6. Carbon residue (Rans bottom) percent by pass (max.)	1.50	
	7. Acidity in organic	Nil	
	8. Flash point(Min.) - Pensky Martens	66 deg.C	
	9. Copper strip corrosion for 3 hours at 100°C	Not worse than No. 2	
	10. Water content, % by volume(max)	0.25	
	11. GCV (Kcal/kg)	10,000	
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-0011-109-(6)2	SUB-SECTION-II A3 PROJECT INFORMATION SIPAT STPP-II (2X500 MW)	PAGE 20 OF 24

CLAUSE NO.	PROJECT INFORMATION		एन टी पी सी NTPC
10.00.00	STEAM GENERATOR DATA		Table-3
	<ol style="list-style-type: none"> 1. Location 2. Operation 3. Type 4. Maximum Continuous Rating 5. Steam pressure at SH outlet 6. Steam temperature at SH outlet 7. Oil for start up and flame stabilisation 8. Fuel oil system sizing 9. Pulverised coal size 10. Type of pulveriser 11. Type of oil burners 12. No. of air heaters 13. No. of ID Fans 	<p style="text-align: right;">Outdoor</p> <p style="text-align: right;">Base load</p> <p style="text-align: right;">Pulverised coal fired</p> <p style="text-align: right;">1625 Tonns/hr.</p> <p style="text-align: right;">179 Kg/cm²(a)</p> <p style="text-align: right;">540°C</p> <p style="text-align: right;">LDO + LSHS/HPS</p> <p style="text-align: right;">30% of Boiler MCR for LSHS/HPS 7.5% of Boiler MCR for LDO</p> <p style="text-align: right;">Minimum 70% through 200 Mesh</p> <p style="text-align: right;">Bowl Mills XRP-1003</p> <p style="text-align: right;">Air atomised for LDO Steam atomised for LSHS/HPS</p> <p style="text-align: right;">Two (2) for the secondary air side and Two (2) for the primary air side.</p> <p style="text-align: right;">Two (both working)</p>	
10.00.00	ESP DATA		
	1. Location:	Downstream side of Air preheaters	
	2. Operation:	Base load	
	3. Type:	Rigid Discharge frame	
	4. Rapping:	Intermittent	
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-0011-109-(6)2	SUB-SECTION-II A3 PROJECT INFORMATION SIPAT STPP-II (2X500 MW)	PAGE 21 OF 24

CLAUSE NO.	PROJECT INFORMATION			
				Table-4
	WATER ANALYSIS			
	COOLING WATER ANALYSIS /CW BLOW DOWN WATER ANALYSIS			
	Sl. No.	Constituent	as	mg per litre

	1.	Calcium	CaCO ₃	256
	2.	Magnesium	CaCO ₃	70
	3.	Sodium	CaCO ₃	125
	4.	Potassium	CaCO ₃	0
	5.	Total Cations	CaCO ₃	451
	6.	Bicarbonates	CaCO ₃	178.5
	7.	Carbonates	CaCO ₃	0
	8.	Nitrate	CaCO ₃	0
	9.	Chloride	CaCO ₃	75
	10.	Sulphate	CaCO ₃	197.5
	11.	Total Anions	CaCO ₃	451
	12.	Silica	SiO ₂	55
	13.	Iron	Fe	1.5
	14.	pH Value	-	7.8-8.2
	15.	Turbidity	NTU	100
	16.	Total Dissolved solids	CaCO ₃	528.05
	17.	Organic matter (Oxygen absorbed from Acid Permanganate In 4 Hrs.)		mg/l 0.25
	Note : The C.W system is expected to operate at about 5 Cycles of Concentration.			
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-0011-109-(6)2	SUB-SECTION-II A3 PROJECT INFORMATION SIPAT STPP-II (2X500 MW)	PAGE 22 OF 24	

CLAUSE NO.	PROJECT INFORMATION			
	CLARIFIED WATER ANALYSIS			Table-5
	Sl. No.	Constituent	as	mg per litre
	1.	Calcium	CaCO ₃	51.2
	2.	Magnesium	CaCO ₃	14
	3.	Sodium	CaCO ₃	25
	4.	Potassium	CaCO ₃	0
	5.	Total Cations	CaCO ₃	90.2
	6.	Bicarbonates	CaCO ₃	35.7
	7.	Carbonates	CaCO ₃	0
	8.	Nitrate	CaCO ₃	0
	9.	Chloride	CaCO ₃	15
	10.	Sulphate	CaCO ₃	39.5
	11.	Total Anions	CaCO ₃	90.2
	12.	Silica	SiO ₂	11
	13.	Iron	Fe	0.3
	14.	pH Value	-	6.8-8
	15.	Turbidity	NTU	20
	16.	Total Dissolved solids	CaCO ₃	105.61
	17.	Organic matter (Oxygen absorbed from Acid Permanganate In 4 Hrs.)	mg/l	0.05
	ANALYSIS OF DM WATER			Table-5A
	Sl. No.	Constituent	as	mg per litre
	1.	Silica	SiO ₂	.02 ppm
	2.	Iron	Fe	Nil
	3.	Total Hardness		Nil
	4.	PH Value		6.8 to 7.2
	5.	Conductivity		Not more than 0.1 excluding
	6.	Bicarbonates		the effects of free CO ₂
	Drawings are enclosed as per Table-6 for initial overview to the Bidder.			
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-0011-109-(6)2	SUB-SECTION-II A3 PROJECT INFORMATION SIPAT STPP-II (2X500 MW)	PAGE 23 OF 24	

CLAUSE NO.	PROJECT INFORMATION																						
	Table-6																						
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">SI.No.</th> <th style="width: 50%;">Drawing Description</th> <th style="width: 40%;">Drawing No.</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>General Layout Plan</td> <td>9545-999-POM-A-001</td> </tr> <tr> <td>2.</td> <td>Topographical Survey</td> <td>Enclosed</td> </tr> <tr> <td>3.</td> <td>ID System-Elevation & Plan</td> <td>9545-102-01-TR-PVM-F-004 9545-102-01-TR-PVM-F-005</td> </tr> <tr> <td>4.</td> <td>ID System Foundation Plan</td> <td>9545-102-01-TR-PVC-W-008-00</td> </tr> <tr> <td>5.</td> <td>Trestle Drawings</td> <td>Enclosed</td> </tr> </tbody> </table>			SI.No.	Drawing Description	Drawing No.	1.	General Layout Plan	9545-999-POM-A-001	2.	Topographical Survey	Enclosed	3.	ID System-Elevation & Plan	9545-102-01-TR-PVM-F-004 9545-102-01-TR-PVM-F-005	4.	ID System Foundation Plan	9545-102-01-TR-PVC-W-008-00	5.	Trestle Drawings	Enclosed		
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4.	ID System Foundation Plan	9545-102-01-TR-PVC-W-008-00																					
5.	Trestle Drawings	Enclosed																					
	Existing Chimney details Sipat Stage II:																						
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Unit</th> <th style="width: 15%;">Shell OD at ground level</th> <th style="width: 15%;">Foundation Raft OD</th> <th style="width: 20%;">Type of foundation</th> <th style="width: 15%;">Top Elevation of Foundation Raft (m)</th> <th style="width: 25%;">Level of Bottom of foundation (m)</th> </tr> </thead> <tbody> <tr> <td></td> <td style="text-align: center;"><i>m</i></td> <td style="text-align: center;"><i>m</i></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Unit-4</td> <td rowspan="2" style="text-align: center;">34.375</td> <td rowspan="2" style="text-align: center;">46</td> <td rowspan="2" style="text-align: center;">OPEN RAFT</td> <td rowspan="2" style="text-align: center;">RL (+) 279.25m</td> <td rowspan="2" style="text-align: center;">RL (+) 275.25m</td> </tr> <tr> <td>Unit-5</td> </tr> </tbody> </table>			Unit	Shell OD at ground level	Foundation Raft OD	Type of foundation	Top Elevation of Foundation Raft (m)	Level of Bottom of foundation (m)		<i>m</i>	<i>m</i>				Unit-4	34.375	46	OPEN RAFT	RL (+) 279.25m	RL (+) 275.25m	Unit-5	
Unit	Shell OD at ground level	Foundation Raft OD	Type of foundation	Top Elevation of Foundation Raft (m)	Level of Bottom of foundation (m)																		
	<i>m</i>	<i>m</i>																					
Unit-4	34.375	46	OPEN RAFT	RL (+) 279.25m	RL (+) 275.25m																		
Unit-5																							
	<p>Note: All the above drawings are only indicative and given to provide the Bidder a preliminary overview. These may be at variance from actual site details. The Bidder shall visit the site to carry out his own assessment verify these before finalizing its renovation and modernization proposal.</p>																						
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI BID DOC NO.: CS-0011-109-(6)2	SUB-SECTION-II A3 PROJECT INFORMATION SIPAT STPP-II (2X500 MW)	PAGE 24 OF 24																			



2X500MW NTPC SIPAT STPP, STAGE-II
TECHNICAL SPECIFICATIONS FOR
MISC. TANKS (SITE FABRICATED) AND
AGITATORS

SPECIFICATION No: PE-TS-491-167-A001

SECTION-I, SUB-SECTION-C1


REV. 00

DATE: NOV 2022

**SECTION-I,
SUB-SECTION-C1**


**SPECIFIC TECHNICAL REQUIREMENT –
MECHANICAL**

1172525/2022/PS-PEM-MAX

	2X500MW NTPC SIPAT STPP, STAGE-II TECHNICAL SPECIFICATIONS FOR MISC. TANKS (SITE FABRICATED) AND AGITATORS	SPECIFICATION NO. PE-TS-491-167-A001	
		SECTION -I, SUB SECTION -C1A	
		REVISION 00	DATE: NOV 2022


SUB SECTION-C1A

SPECIFIC TECHNICAL REQUIREMENTS - TANKS

	<p style="text-align: center;">2X500MW NTPC SIPAT STPP, STAGE-II TECHNICAL SPECIFICATIONS FOR MISC. TANKS (SITE FABRICATED) AND AGITATORS</p>	SPECIFICATION NO. PE-TS-491-167-A001	
		SECTION –I, SUB SECTION –C1A	
		REVISION 00	DATE: NOV 2022

1.0 SCOPE OF SUPPLY

- 1.1 Steel tanks fabricated and supplied at site under this specification shall be as per enclosed FGD Tank schedule (Section-I, Sub Section-D, Annexure-III) and GA DRAWINGS OF TANKS (Section-I, Sub Section-D, Annexure-V). Modifications may be made by the bidder to suit good engineering practice to the satisfaction of the customer. The customer, however, reserves the right to reject any modifications. **Steel plates (Only for Shell, Roof, Bottom & Baffle plates) for Tanks shall be supplied as Free issue by BHEL.**
- 1.2 General design, selection of rubber/glass flake lining materials, construction features, manufacturing, shop inspection, testing at manufacturer's works, surface preparation, lining, inspection & testing of the lined surface at site. For detail specification of rubber/glass flake lining refer Sub Section-C1-B/C1-C, section-I.
- 1.3
- a) The connections and accessories which are required to be supplied with each tank by the bidder shall be as indicated in the enclosed **FGD Tank schedule and GA drwgs of Tanks.**
- b) The piping material inside the tank shall be supplied by the bidder. All inlet piping shall be extended up to the bottom of the tank and the clearance between the bottom of the tank and the edge of the inlet piping shall be kept as 500 mm (maximum).
The inlet pipes for slurry storage tanks shall be lined with replaceable wear resistant natural rubber lining of minimum 6 mm thickness from inside. Additional thickness of 2 mm in rubber lining shall be provided at bends. Pipes and fittings for the FGD tanks is excluded from the bidder scope. However, tank nozzles with glass flake/rubber lining shall be in bidder's scope. Also pipe supports on the inside surfaces of the tank shall be in bidder's scope.
- c) The inside piping shall be adequately supported and shall be provided with adequately sized vent(anti-siphoner) connection at pipe top.
- d) Weir plates of adequate thickness (minimum 8 mm) shall be provided for all inlet piping.
- e) Pad plates on the tanks for welding support structure of '**outside & inside piping, cable trays & Tie Rod Lug of Side Entry Agitator**' shall be provided by the bidder. Details of the pad plates (sizes, quantity etc.) shall be informed to bidder during detail engineering.
- f) Fabrication and supply of all flanges and counter flanges for all nozzles of tank connections shall be included in the scope of work of the bidder. Necessary bolts, nuts and gaskets for these connections shall also be supplied by the bidder. **Further, rubber lining of these nozzles** including flanges, counter-flanges shall be in bidder's scope of work.
- g) The manhole shall be of hinged and bolted type with nuts, bolts and gaskets in bidder's scope of supply. The size of the manhole shall be minimum 800 mm if not specified in the specification. Further, the Size of the shell manhole, shall be provided considering the ease of removal of the Agitator hub and shaft assembly.
- h) All Slurry Tanks' drain nozzle to be provided with drain box 500 mm². For details refer "DETAILS OF 500 MM NOZZLE FOR BOTTOM DRAIN"- Annexure-VI, Sub-Section-D, Section-1.


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- 1.4 **The scope of works shall also include supply and installation of special accessories including Agitators, agitator supporting arrangements, agitator platform, baffle plates, support structure for Agitator handling equipment above Roof etc. as indicated in GA drwgs of Tanks. The necessary fixtures and other accessories for mounting these special accessories shall be included in the scope of work of the bidder.**
- 1.5 Baffle plates for the agitators shall be mounted on the tank. The erection of the baffle plates shall be in bidder's scope of work. The minimum no. of baffle plates and minimum dimension of the baffle plates have been indicated in the drawing attached with the Tank schedule. The final quantity and dimensions of the baffle plates shall be as per agitator OEM recommendations and shall be decided during detail engineering.
- 1.6 Void.
- 1.7 Pipes, fittings, nozzles, flanges and counter flanges **along with the rubber lining** shall be supplied by the bidder. The minimum requirement like quantity, size, type, MOC etc. are indicated in the GA drwgs of Tanks and may undergo change during detail engineering stage and these shall be supplied by the bidder as per the approved drawings / documents for which no commercial implication shall be entertained by BHEL.
- 1.8 The minimum number of anchor bolts along with the minimum size has been specified in Tanks GA drwgs. However, any additional anchor bolts of higher size if found applicable during detailed Engineering shall be provided by bidder without any commercial implication.
- 1.9 Painting of the tanks is included in bidder's scope of work. Painting specifications of storage tanks are given under Painting schedule in GA drwgs of tanks. Painting requirements specified are minimum requirement. Any modification in painting requirement found applicable during detained engineering, shall be under bidder's scope without any commercial implication.
- 1.10 Commissioning spares as required for commissioning of the tanks are in bidder's scope.
- 1.11 Platforms, inter-connecting platforms, platforms for agitator maintenance, monkey ladder inside tank, staircase, hand railing, knee guard and toe guard (in stair case, agitator platform and all along the periphery of roof of the tank), as per the relevant design code / good engineering practice shall be included in bidder's scope of work. All staircase treads and platforms shall be 32 mm steel fabricated gratings. Gratings shall be galvanized as per latest code/standard. Width of staircase shall be 1200 mm.
- 1.12 Any other item required for making the installation complete in all respect and for satisfactory operation of the tank and items mounted thereon, meet layout and accessibility & operability requirements for the scope within the terminal points useless specifically mentioned under EXCLUSION.

2.0 SCOPE OF SERVICES

Services shall include but not be limited to the followings:

- 2.1 Design, engineering, preparation of detailed fabrication drawings, GA drawings, design calculation, bill of material, tag and piece numbers, welding procedures etc. Stiffeners and other structural


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framing for supporting the tank shall be designed by the fabricator and properly shown in the fabrication drawings.

- 2.2 Erection & Commissioning of Tanks and Agitators.
- 2.3 Erection & Commissioning of rubber/glass flake lining **in Tanks and Sumps**.
- 2.4 Erection of the agitators, agitator mounting arrangement, agitator supporting arrangements, Support **Structure for agitator handling equipment above tank Roof** etc., shall be in bidder scope. The Agitator shall be provided by BHEL as a free issue item.
- 2.5 Erection of all foundation bolts / anchor bolts etc. as required for any equipment/ foundation /concrete.
- 2.6 Minor civil work like chipping of foundation, grouting below base plate for all structures, Tanks, equipment, grouting of pockets. Supply of grouting material is under bidder's scope.
- 2.7 Inspection & testing and carrying out demonstration test of tanks and Agitators.
- 2.8 Inspection & testing and carrying out demonstration test for the rubber/glass flake lining of tanks.
- 2.9 Painting of tank and other equipment within the battery limit.
- 2.10 Any other services as required to make the installation complete in all respects shall be deemed to be included in bidder's scope of work whether mentioned above or not.
- 2.11 Relevant scope of services as per GTR, GCC, SCC & ECC.
- 2.12 Any other service required for making the installation complete in all respect within battery limits and for satisfactory erection & commissioning of the system unless specifically mentioned under EXCLUSION.


3.0 DESIGN CONSIDERATIONS

- 3.1 The successful bidder shall furnish design calculations to BHEL during detailed engineering stage for approval along with relevant pages of authentic supporting literature e.g. Code, Hand book, National / international Standards etc. Calculation shall be necessarily done in **SI UNITS** only for the followings:
 - a) Tanks shall be designed as per IS – 803 / API – 650 / AWWA – D 100 / IS –2825 / BS – 2594 / Good engineering practice as applicable and referred code shall be of latest edition.
 - b) Weight calculation of plates, appurtenances, platforms & structures separately shall be included in the Design calculation.
 - c) Design of roof and roof structures for vertical storage tanks along with agitators & agitator platforms shall be designed based on guidelines given in the book titled "Process equipment design" by Brownell and Young. **Further, roof structure shall preferably be constructed on external side of roof.**
 - d) Tank stability calculation (wind load / seismic / overturning stability) considering static and dynamic loads of Agitator and its platforms and supporting arrangement shall be done as per API – 650/IS-

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803, latest edition. However, factors / coefficients as required for the design of tank shall be obtained from BHEL by the bidder after placement of order.

- d) Vent sizing calculation shall be done as per API – 2000, latest edition
- e) Void.
- 3.2 The successful bidder shall indicate references of all the clauses indicating their page number from respective standard in the design calculation during detail engineering stage. All steps including formulas and abbreviations shall be clearly shown in the calculation. All inputs / assumptions shall be indicated in the first sheet of the calculation.
- 3.3
- a) Bottom plate shall be 8.0 mm thick (minimum). Minimum 8 mm (for slurry tanks with agitators) & 6mm (for water tanks) (excluding tolerance on plate as per relevant IS), thick plates including corrosion allowance shall be provided for shell plates and minimum 8 mm for roof plates for all tanks.
- b) Negative tolerance on plate thickness shall not be considered in the plate thickness calculation and also shall not be provided in the tank. Only positive tolerance shall be considered.
- 3.4 Tank shall be suitably constructed for safe, proper and continuous operation under all conditions that can be expected in a plant life without undue strain, corrosion or other operating difficulties.
- 3.5 In calculating the minimum plate thickness, the specific gravity of the liquid shall be taken as per Tank schedule.
- 3.6 For cylindrical tanks, the plates shall be cold rolled through plate bending machine by several number of passes to true curvature.
- 3.7 Vessels seams shall be so positioned that they do not pass though vessel connections. For cylindrical vessels consisting of more than two sections longitudinal seams shall be offset.
- 3.8 Wherever possible, the inside seam weld shall be ground smooth, suitable for application of corrosion resistant primer.
- 3.9 The joint efficiency factor to be adopted for design calculation of shell thickness shall be as per relevant design code.
- 3.10 All roofs and supporting structures shall be designed to support dead load plus a uniform live load of not less than 150 kg/m² of projected area. Further, the static and dynamic loads of the agitator assembly along with the agitator platform & support structure for Agitator handling equipment shall be considered over and above the uniform live load.
- 3.11 Code conformance for flanges / counter flanges shall be ANSI B 16.5. Code conformance for bolts and nuts shall be SA 193 & 194 respectively. Further, all fasteners used in wetted condition must be of Alloy 926 or better material so that even if it comes in contact with liquid by swelling of rubber lining, thread remains unaffected. Raw material of fastener must undergo Inter-Granular Corrosion test as per ISO-3651, Part-1 for Nitric Acid test.

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- 3.12 The number & size of nozzles (including flanges, counter flanges and inside piping) indicated in the tank schedule are tentative and bidder guidance purpose only and the same may undergo change during detail engineering stage for which no commercial implication shall be entertained by BHEL.
- 3.13 Bidder shall furnish the STADD calculation for following:
a. Roof Structure calculations for checking the stability of roof.
b. Shell buckling under Roof and other Shell Appurtenances loading.
- 3.14 Bidder to note that surface cleaning shall be of Blast clean type. However, Grit blasting shall be decided during detail engineering for which no commercial implication shall be entertained by BHEL. Further, the surface cleaning of the tanks shall be in line with the requirements specified in the specification for rubber/glass flake lining (Section-I, Sub Section-C1B)
- 3.15 Bidder to note that foundation drawing along with loading data & anchor bolt details shall be provided by bidder within two weeks' time from the LOI. However, Bidder to provide minimum anchor bolts for the Miscellaneous FGD tanks, as specified in Tank schedule.
- 3.16 A corrosion allowance of 1.5 mm shall be considered for calculating the shell thickness of tanks.
- 3.17 Tanks with diameter more than 3.75m, shall be provided with Roof Structural Support in the form of Rafters and a Center Column.
- 3.18 Bidder will need to use appropriate Software for addressing the Agitator Dynamic load in the tank design calculation. In this regard, the Stress analysis(FEA) including analysis of Agitator mounting, nozzle, platform etc., shall be carried out by the bidder using the latest version of software accepted internationally for FEA. All relevant backups such as load calculations, flow charts, computer data etc. shall be furnished. Computer outputs shall be clear and in easily understandable format.

4.0 WELDING

- 4.1 Welding shall be in accordance with the requirement of IS: 803, 816, 817 and 823 or equivalent and as specified in the specification for lining (Section-I, Sub-Section-C1B).
- 4.2 Welding sequence shall be adopted in such a way so as to minimize the distortion due to welding shrinkage. Contractor shall indicate in his drawing the sequence of welding proposed by him, which should meet prior approval of the Engineer.
- 4.3 All welders shall be BHEL / customer / consultant qualified as per the approved quality plan / field quality plan which will be submitted by the successful bidder during detail engineering stage. WPS and PQR shall be submitted by the successful bidder to BHEL / customer / consultant for review and approval.

5.0 TEST AND INSPECTION

- 5.1 The particulars of the proposed tests and the procedure for the tests shall be submitted to the Owner / Engineer for approval before conducting the tests. The successful bidder shall submit FQP (field quality plan) and demonstration test procedure for BHEL / customer / consultant's approval during detail engineering stage. In the event of any change in the field quality plan and demonstration test procedure, the same shall be incorporated by the bidder in the document and approved document shall be adhered by the bidder without any commercial implication.

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5.2 DPT / MPI on all welds (100%).

5.3 All cross / Tee joints and butt welds to be Radio graphed in line with the joint efficiency as specified.

5.4 For the offered tanks, Hydro fill test shall be carried out for at least 24 hours. Atmospheric storage tanks on inside surface shall be leak tested before painting/ rubber or glass flake lining.

5.5 All quality plans / checklists for various items shall be furnished during detail engineering stage for BHEL / customer's approval and any changes required by BHEL / customer shall be incorporated in the documents and adhered without any price implication. However, minimum requirement of MQP as indicated in the technical specification shall be followed. All necessary items as required for inspection and testing of the tank including instruments shall be arranged by the bidder.

6.0 MANDATORY SPARES:

Mandatory Spares shall be supplied as per Annexure-IX, Sub-Section-D, Section-I.

7.0 LIST OF COMMISSIONING SPARES:


The items required for successful commissioning of the Tanks, Agitators and Rubber/Glass Flake lining shall be specified by bidder under 'List of commissioning Spares' given under Section-III of specification.

8.0 TERMINAL POINTS

- Matching counter flanges for all nozzles mounted on the tanks. However, counter flanges for all nozzles of tank shall be provided by the bidder.

9.0 EXCLUSIONS

- 1) Steel Plates for All tanks (Only for shell, Roof, Bottom of tank & Baffle plate of agitators). Same shall be issued free of cost by BHEL.
- 2) Tank foundation & associated civil works, all instruments like level gauges, Level Transmitters, etc are excluded from bidder's scope of work. However, required no. of nozzles for the same shall be in bidder's scope of work.
- 3) The Sumps/drain pits indicated in the **Tank schedule** is excluded from bidder's scope of work. However, the supply, erection and commissioning of the agitators, agitator supporting arrangement and lining within the sump/drain pits shall be in bidder's scope of work.
- 4) All valves are excluded from bidder's scope of work.
- 5) All piping from the counter flange of the nozzles of respective tanks is excluded from bidder's scope of work. However, matching counter flanges for all nozzle shall be in bidder's scope of work. Further the supply and erection of the piping material inside the tank shall be in bidder's scope. The rubber lining of the inlet pipes shall be in bidder's scope of work.
- 6) Chain pulley blocks/electric hoist required for the handling of Agitators is excluded from the scope of bidder. However, the handling arrangement (support structure) on the roof of the tank shall be in bidder's scope.

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10.0 DRAWINGS AND DOCUMENTS TO BE SUBMITTED WITH THE BID


The bidder must submit the drawings / documents as mentioned under “LIST OF DOCUMENTS TO BE SUBMITTED WITH BID” (In Section-III, Annexure-I) along with their bid. In absence of any of these documents, BHEL reserves right not to evaluate the offer of the concerned bidder.

11.0 DRAWINGS/ DOCUMENTS REQUIRED DURING DETAIL ENGINEERING

The successful bidder shall submit the drawing / documents as mentioned under SECTION-I, Sub-Section-D, Annexure-IV during detail engineering for approval / information / reference (as the case may be).

12.0 OTHER TECHNICAL REQUIREMENTS

- 1) 15 days' time is required by BHEL to offer their comments on the drawings and documents being submitted by the bidder (during detailed engineering stage in the event of L.O.I being placed) from the date of receipt.
- 2) Bidder to depute competent designer (s) at BHEL's office during detailed engineering stage to discuss drawings and other technical documents as and when required by BHEL.
- 3) Bidder to assess the capability of their sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them. No deviations shall be entertained.
- 4) Commercial implication includes price implication as well as delivery implication.
- 5) Size of hand rails on stairway and tank roof / top shall be minimum 32 NB and shall conform to IS 1239 (M). Handrails shall be galvanized as per relevant code/standard.
- 6) Type of roof for vertical cylindrical storage tanks shall be either supported cone roof as per latest edition of relevant design code.
- 7) Commissioning of tanks will consist of installation of all accessories of tanks as per approved drawing/specification, charging of tank, water-fill test (for minimum 24 hours after complete filling of tank), satisfactory functioning of all accessories, emptying of tank, subsequent painting of complete tanks and changing of gaskets as per specification requirement.
- 8) Bidder to furnish prices and unit price of each item of proposed tanks as per BHEL's price format only along with the final price bid.
- 9) Bidder shall check that specifications of all the items are available in the NIT specification. However, in the event of absence of specification for any item, bidder will approach BHEL to furnish the specification of missing items and new specification will be adhered by the bidder for which no commercial implication shall be entertained by BHEL.
- 10) All tools and plants including welding machines, crane, hydra, etc. and instruments as required for construction, erection and commissioning, trial run and functional demonstration test at site shall be arranged by the bidder.

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- 11) Bidder to furnish list of sub-vendors based on sub-vendor list enclosed with the specification during detail engineering stage for BHEL's / Customer review and approval and items shall be procured from these suppliers only.
- 12) Dealers are not acceptable for any item of the package. Bidder shall procure all items including plates, structural, flanges, counter flanges etc. from BHEL approved sub vendor only. No argument on this account shall be entertained.
- 13) All rubber lined pipes shall be provided with flanged type connections only. In other words, Rubber lined pipes shall be flange joined only.
- 14) Supplier shall prepare the Tanks' model in an integrated & intelligent 3D software solution using rule-based, data centric 3D Design software with equipment drawings, data sheets, BOQ, schematics etc. attached to the respective equipment / systems in the aforesaid 3D model.
- 15) Percentage of Billing break-up has been given under Annexure-XII, Sub Section-D, Section-I. Bidder to follow the percentages given therein against each item while submitting the detailed billing break-up during Detailed Engineering.



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**SECTION-I,
SUB-SECTION-C1B**

**SPECIFIC TECHNICAL REQUIREMENT –
AGITATOR**

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1.0. APPLICABLE CODES & REGULATIONS

The design and materials shall conform to the requirements of applicable codes and regulations of the latest edition. The design, manufacture, installation and testing of the Agitator shall follow the latest applicable Indian/International (AISI / ASME/EN/Japanese) Standards.

Bidder shall supply the equipment in accordance with relevant regulations, codes and standards specified in the specification. If required by relevant regulations, codes and standards specified in the specification, Successful Bidder shall assist BHEL to obtain approval against the equipment, documents and drawings by Indian authorities.

2.0. PROVENNESS CRITERIA / PRE-QUALIFICATION REQUIREMENT

The Bidders are required to meet the Qualification Requirement (PQR) for Agitators as per provenness criteria & shall submit the credentials as called in the tender document. Only OEMs qualifying as per the qualification requirement shall be considered for placement of order.


3.0. TECHNICAL INFORMATION

3.1 AGITATOR DETAILS:

For details of Agitators Refer "Agitator Schedule" in Sub-Section-D, Section-I, Annexure-VII of the specification.

3.2 MATERIAL OF CONSTRUCTION


Sl. No.	Material of construction	Horizontal agitators (side entry)	Vertical Agitators (Top entry)
i.	Impeller blade	Alloy 926 or better material	Alloy 926 or better material
ii.	Impeller Hub	Alloy 926 or better material	Alloy 926 or better material (or) Carbon steel with 6mm thick Bromo/Chloro Butyl Rubber Lining (as per proven practice)
iii.	Shaft	Alloy 926 or better material	CS with Rubber Lining (min 6 mm thick Chloro/bromo butyl Rubber)
iv.	Fasteners in wetted parts	Alloy 926 or better material	Alloy 926 or better material
v.	Fasteners in Non-Wetted	GI fastener (40 μ plated) / SS	GI fastener (40 μ plated) / SS

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vi.	Mounting base	Alloy 926 or better material (Wetted parts)	Carbon Steel
vii.	Tank Nozzle (for inserting agitator) with Flange	Not applicable (in BHEL scope)	Not applicable (in BHEL scope)
viii.	Flush pipe for Startup with flange (BHEL SCOPE)	Not applicable (in BHEL scope)	Not applicable (in BHEL scope)
ix.	Tank nozzle with flange (for Flush Pipe)	Not applicable (in BHEL scope)	Not applicable (in BHEL scope)
x.	Agitator Support Leg	Carbon Steel	Not applicable

3.3 POWER SUPPLY DETAILS:

1.	POWER SUPPLY	
	The following voltage levels shall apply:	
	3 phase, 6.6 kV AC ,50 Hz	Voltage for motors rated 175 kW and up to 1500 kW and for power distribution within the plant.
	3 phase, 415 V, AC, 50 Hz	Standard voltage for power supplies to electric power consumers and motors Above 0.2 KW and up to 175 (200) kW.
	1 phase 240V AC / 3 phase 415 V AC, 50 Hz	Standard voltage for power supplies to electric power consumers and motors Up to 0.2 kW.
	<ol style="list-style-type: none"> All equipments at 415V voltage level shall be suitable for voltage variation of $\pm 10\%$ and rated frequency of 50 Hz with a variation of + 3% to -5%, and 10 % (absolute sum) combined variation of voltage and frequency unless specifically brought out in the specification. Bidder shall design and supply the equipment suitable for satisfactory operation under above mentioned power supply condition. For further details refer electrical specification under Section-I, Sub-Section-C3. 	

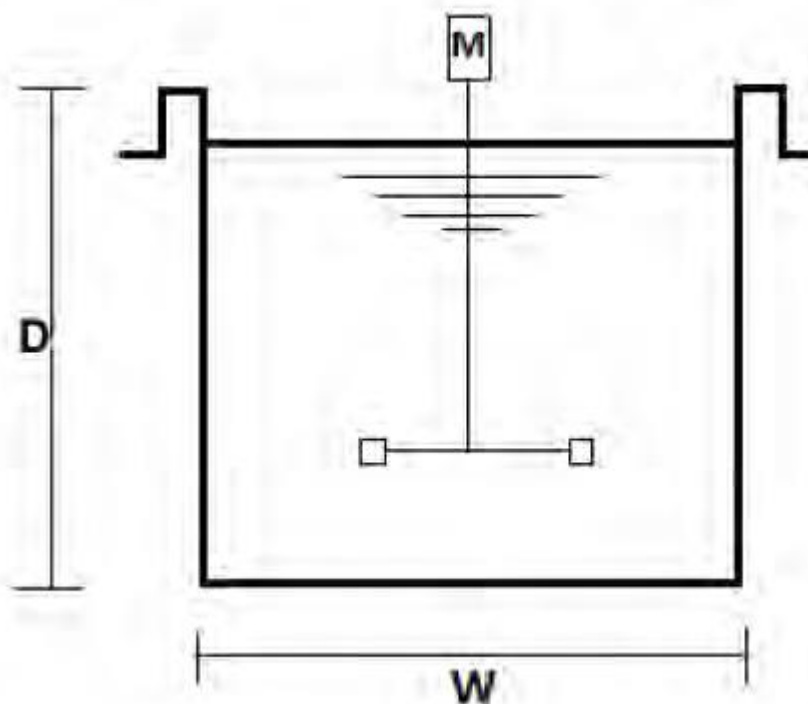
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3.4 AGITATOR ARRANGEMENT

For arrangement of Agitators please refer “GA DRAWING OF SLURRY TANKS” under Annexure-V, Sub-Section-D, Section-I.

Auxiliary Absorber Tank Agitators will operate continuously when Limestone / Gypsum Slurry is evacuated from Absorber for any Absorber maintenance work. Other Slurry Tanks and sumps Agitators will operate continuously for FGD system operation.

Drain Pit Tank Agitators:




For details of Drain Pits please refer “AGITATOR SCHEDULE” under Annexure-VII, Sub-Section-D, Section-I of the specification. These Agitators will operate continuously for FGD system operation.

4 SCOPE OF SUPPLY & SERVICES FOR AGITATORS

The bidder shall assume sole responsibility for the design, fabrication, testing, surface preparation, painting, packing, transportation and performance of the specified equipment with accessories, and shall ensure that the equipment with accessories are in conformance with this specification, as well as other documents which form part of the Purchase Order/Contract.

Various inspections by the BHEL/NTPC shall not relieve the Bidder in any way of his obligation to maintain an adequate test, inspection, and documentation program of his own, and shall not relieve the Bidder of any other obligation under this specification. Furthermore, any inadvertent overlook of

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deviations from some requirements of this specification by the buyer shall not constitute a waiver of these requirements, or of the Bidder's obligation to correct the condition when it is discovered, or of any other obligation under this specification.

This specification only states the lowest technical requirement, neither specifying all technical details, nor referring the pertaining code and standard fully. It is the Bidder's responsibility to ensure that the complete delivery complies with all relevant codes, standards and specifications.

The Bidder is obliged to supply relevant drawings and documentation to the buyer. All to be in English language and metric system, if not otherwise agreed in writing.

Scope for the bidders shall include Design, Manufacturing, Supply, and Erection & Commissioning.

Design: Broadly 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 customer.

Supply: The scope includes the following:

Includes manufacturing/fabrication, shop floor testing, stage inspections, final inspections, painting & packing.

Mandatory spares as defined as Section-I, Sub-Section-D, Annexure-IX.

Recommended spare parts list to be furnished (is not part of scope of supply)

Any special tools & tackles required for the entire equipment to disassemble assemble or maintain the units.

Start-up & Commissioning Spares

First fill of consumables


Services: Services to be provided by the bidder:

Erection & Commissioning, trial run at site.

Performance guarantee tests at site & handover in flawless condition of the package to the customer

Training of customer/ client O&M staff covering all aspects of the Agitators - Operation & Maintenance, Trouble-shooting etc. at site


Training of customer at manufacturer's works (3 persons for 2 days including lodging and boarding)

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The scope of supply for AGITATORS shall include but not limited to the following:


A) For Horizontal (Side Entry) Agitators:

Sl. No	Scope
1.	AGITATOR complete with
	i. AGITATOR Blades
	ii. AGITATOR Shafts
	iii. Coupling arrangement (Flexible)
	iv. Single Mechanical Seals
	v. Shaft Sleeve
	vi. Lanterns/ Stools (Bearing Housing), Safety Guard
	vii. Bearings
	viii. Agitator Mounting Flanges with gaskets and fasteners
	ix. Drive Motor (IE3) with gearbox arrangement
	x. Supporting arrangement including tie rods, gusset plates etc. of Side Entry Agitator on the tank Wall. Nozzle and mating flange for supporting on the tank wall, gaskets and fasteners.
	xi. VOID.
	xii. Foundation plate with foundation bolts
	xiii. Painting and Rust Prevention during shipment and construction
	xiv. Packing and transportation
	xv. VOID.
	xvi. Special tools & tackles as applicable
	xvii. Start-up spares, Spare parts for commissioning & erection, Mandatory Spares: As per Project Specific Requirement
	xviii. Installation, operation and maintenance manuals
	xix. Any other items required for completeness of the equipment except the items covered in the exclusions.

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B) For Vertical (Top Entry) Agitators:

Sl. No	Scope
1.	AGITATOR complete with
	i. AGITATOR Blades
	ii. AGITATOR Shafts
	iii. Coupling arrangement (Flexible)
	iv. Gland Packing, Seals, O Rings, Glands
	v. Shaft Sleeve
	vi. Lanterns/ Stools (Bearing Housing), Safety Guard
	vii. Bearings
	viii. AGITATOR Mounting Flanges with gaskets and fasteners
	ix. Drive Motor (IE3) with gearbox arrangement
	x. Mating Flange for Supporting on Slurry Tank Roof
	xi. Shims
	xii. Painting and Rust Prevention during shipment and construction
	xiii. Packing and transportation
	xiv. VOID.
	xv. Special tools & tackles as applicable
	xvi. Start-up spares, Spare parts for commissioning & erection, Mandatory Spares: As per Project Specific Requirement
	xvii. Installation, operation and maintenance manuals
	xviii. Any other items required for completeness of the equipment except the items covered in the exclusions.


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The quantity, location of the Agitators has been included in the **AGITATOR SCHEDULE** (Sub-Section-D, Section-I, Annexure-VII).


4.1	TECHNICAL REQUIREMENTS
I	Agitators shall be supplied in tanks and vessels to prevent caking and settlement of particles out of the slurry, e.g. in the limestone slurry tank, Auxiliary Absorbent tank, and sumps etc.
II	All agitators shall be designed for continuous operation unless otherwise specified. The design of the agitators shall be of proven type.
III	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 (for side entry agitators), impeller, support legs, agitator mounting flange including bolts nuts and gasket etc.
IV	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.
V	The MOC for Agitators shall be generally as per this Specification, however, this does not release the bidder of the responsibility for selecting the correct materials.
VI	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. It shall be possible to remove the sealing devices of the side mounted agitators without having to drain completely the slurry inside the tank.
VII	-VOID-
VIII	Lifting lugs and eyes and other special tackle shall be provided as necessary to permit easy handling of the agitators and their components.
IX	Static and dynamic (as far as applicable) balancing of all agitators shall be carried out after assembly. Any deviation to this requirement is subject to customer approval during detailed engineering based on applicable codes and standards to be furnished by the bidders.
X	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. For side entry agitators the alternating bending moment resulting from impeller and shaft weight has to be considered additionally.
XI	All exposed moving parts shall be covered by guards.
XII	The shape of the impeller blades of side entry agitator's/top entry 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 slurry specified in the specification. In order to avoid excessive wear impeller tip speeds must not exceed 12 m/s.

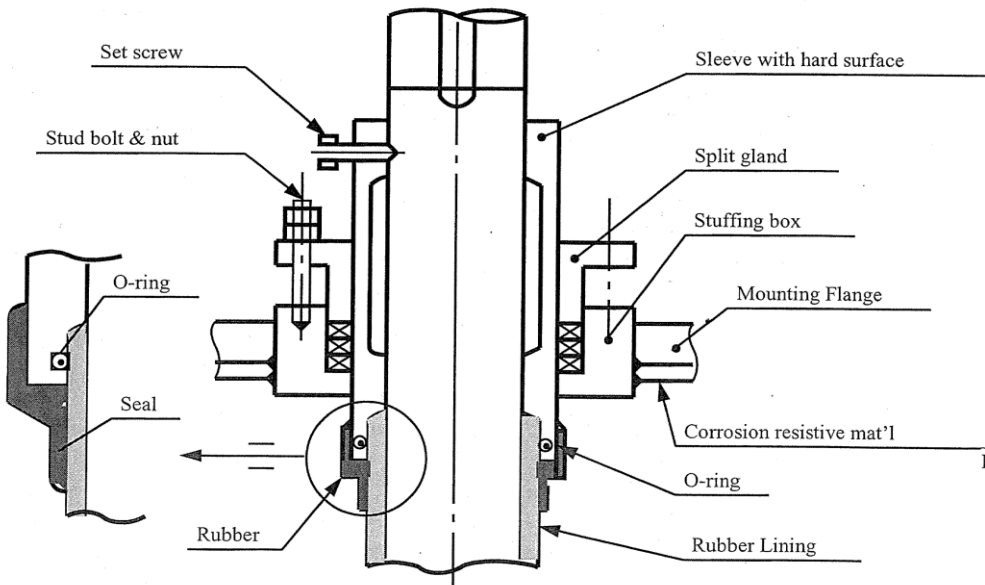
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XIII	Belt drives (if applied for side entry agitators) shall be properly designed to provide a minimum lifetime of 2 years under design conditions
XIV	It shall be noted that all Agitators are meant for keeping the solid particles in suspended mode in liquid with “Full Off-Bottom Suspension” of solid particles to 98% of liquid column to virtually “Uniform Solid Concentration”. No chemical reaction will take place.
XV	Maintaining a uniform concentration over the 95% of liquid column. Absolute sweeping of solid particle from tank bottom is a must for all Agitators. If speed is required to be increased to guarantee the above requirements; the same can be increased by vendor. Bidder's machines that consume less power will be in an advantageous position.
XVI	It is to be noted that in continuous process any deposit at tank bottom is the loss of material which are not getting converted as per process. Hence, total loss of material by sedimentation is a loss to FGD Process & determines the “Inefficiency of the Agitator”.
XVII	Vendor should ensure nil settlement; utilization of solid material shall be a guaranteed parameter and will be assessed in percentage (%) term to net wet of solid mass of inflow or out flow. This is one of the guarantee parameters.
XVIII	Agitator and its driver shall perform on the test stand at shop and on the Agitator’s permanent location at site within vibration limit. The vibration of combined unit will be the responsibility of Agitator manufacturer. Agitator manufacturer is to ensure that Site performance of vibration is one of the “Acceptance Criteria” of the equipment. Please note that vibration at test stand can only be taken as “for information”.
XIX	Every Tank will have a pump whose suction line shall be connected to tank. These pumps are to operate continuously at the lowest operating level which is decided by Process requirement. Hence, the minimum operating level of liquid in every tank for every Agitator is a must to assess the combined operation of Agitator as well as that of pump alone. The Tank water level is indicated in “GA drwgs of Tanks”. Any minor change in liquid level required by Agitator supplier will be accommodated only if it is acceptable to the pump supplier.
XX	Agitator must have low-pitch propeller with low solidity ratio and Power Number. The Maximum Input Power at motor terminal shall be considered as a guaranteed parameter under “Schedule of Guaranteed Power consumption format” in “ SUB-SECTION-D, SECTION-I, ANNEXURE-X ” and the same shall be calculated for maximum liquid level in tank. A calculation of power specifying the hydraulic power of Agitator, Seal loss, Gear box and Motor internal loss must be submitted along with the offer. A characteristics curve showing power versus liquid level should be submitted from the lowest liquid level, required for Agitator to maximum liquid level in the tank. Motor should be selected based on the highest power demand with a 10% margin at maximum liquid level, taking in to account frequency variation.
XXI	The agitator shall be suitably designed for mounting and operation in purchaser’s tank whose details are given under GA drawings of Tanks , annexed with the enquiry specification. The bidder shall review and seek clarifications, if any on Tank GA Drawings.
XXII	In case Bidder provides a Vertical Agitator with hub design, the same has to be of Alloy 926 or better material. Impeller hub material has to be Alloy 926 or better material.

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XXIII	Unless otherwise specified, for small diameter impeller, it shall be possible to remove complete agitator assembly without dismantling through the opening provided on the tank/sump, and for large diameter impeller, the blade shall be of removable construction for ease of removal. Bidder shall also provide the headroom required for taking out the agitator as above.
XXIV	VOID
XXV	Bidder shall provide the design and arrangement of baffle plates in circular tanks.
XXVI	Bidder shall provide proper dowelling between motor and base plate, gear box and mounting tool/base plate, for ease of assembly of agitator unit. Tapered dowel shall be provided.
XXVII	Vendor shall provide suitable arrangement for supporting the agitator shaft with impellers during removal of gear-box for maintenance and details of such arrangements shall be furnished.
4.2	CONSTRUCTIONAL FEATURES
A)	BLADE AND HUB OF PROPELLER
I)	VOID.
II)	The Blade design of the Agitator to be of most efficient design in order to offer least power consumption. The Agitator power consumption is part of the guarantee parameters.
III)	Although Agitator will have substantial low speed because of reduction Gear Box, hydraulic unbalance at impeller can cause severe vibration, hence it is mandatory that rotating assembly shall be dynamically balanced to its rated speed. Any deviation to this requirement is subject to customer approval during detailed engineering based on applicable codes and standards to be furnished by the bidders.
IV)	Impeller should be dynamically balanced to Gr: G16: ISO-1940 after rubber lining of shaft.
B)	SEAL
1	<u>Horizontal / Side Entry Agitators:</u>
I.	Agitators should be provided with Single Stage mechanical seal. The mechanical seal should be as per ISO-21049 / API 682.
II.	The Mechanical Seals shall be so arranged that repacking or fitting of replacement seals can be carried out with the minimum of disruption to plant operation.
III.	Design the mechanical seals chamber to have sufficient room to lubricate and get seal face cool with its own slurry.
IV.	- Provide requirements for periodical flushing to rinse the seal face for leaked slurry.
V.	All mechanical seals, regardless of type or arrangement, shall be of the cartridge design. Hook sleeve cartridge should not be used.
VI.	-VOID-
VII.	Requirement of flushing water, its quantity, and pressure to be indicated in data sheet.

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VIII.	Zero leakage is the intension of this specification. However, quantity of leakage, if it is unavoidable, it should have a provision of collecting / or discharging back to the tank.
IX.	Mechanical seals shall be fitted and installed in the Agitator before shipment and shall be clean. Mechanical seals shall be plugged with screw for shipping.
X	Intention of the specification is not to specify Type of Seal, Seal design, Spring configuration, Seal configuration, Balanced or Unbalance type etc. Agitator manufacturer to decide the same along with seal manufacturer, the best seal that is suitable for the offered Agitator
XI	Seal life has to be guaranteed, taking into consideration all its components for 25000 hrs. If the seals fail before the completion of guaranteed period, the same should be replaced free of cost by the bidder.
XII	The sub-vendor of the seal shall be approved by customer during contract execution.
2	<u>Vertical Agitators for Other Slurry Tanks & Drain Pit Tanks</u>
I	<p>Agitator shall be supplied with stuffing box or any proven equivalent or superior sealing type. Construction of Gland Packing shaft seal system shall be as per the below fig:</p> 
II	Agitator shall be supplied with stuffing box or any proven equivalent or superior sealing type. For type of sealing to be provided for various Agitators please refer Agitator schedule. Mechanical and hydraulic conditions in the seal chamber, required to maintain a stable film at seal face, including temperature, pressure and flow, shall be jointly established by Agitator manufacturer and seal manufacturer, and shall be noted in data sheet submitted in tender. If mechanical seal is offered by bidder, the mechanical seal should be as per ISO-21049 / API 682.


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C)	SHAFT
I.	Use of dissimilar material at flange joint shall be avoided to eliminate any crevice corrosion. Spacing of the shaft joint should not be more than 3.0 m for easy assembly if it is more than 40kg. If welding is used for joining two tubes, welding joint must be 100% radio graphed. If split shaft is proposed for larger tanks, shaft flange at the joining interface has to be rubber lined at manufacturer's works and necessary fasteners have to be provided.
D)	BEARING & BEARING HOUSING IN GEAR BOX
I	Bearing shall be of rolling type radial and thrust bearing (FAG/SKF/Timken make only) as required. Thrust bearing shall be sized for continuous operation under all specified condition.
II	Thrust bearing shall provide full load capability if the Agitator's normal direction of rotation is reversed. Up-thrust and Down-thrust load must be considered in sizing bearing. Life of every anti-friction bearing, used in the bearing housing as per manufacturer's design, should have L10 of 25000 hr. (minimum) .
III	Bearing housing should be grease/oil lubricated. If bearing is oil lubricated, constant-level sight-feed oiler of 100cc size or bigger capacity is to be provided. Bearing housing should have oil drain, constant oil level indicator. A provision of one (1) number G1/2" thread (ISO-228, Part-1) port is required for remote control of temperature of bearing housing oil bath through RTD.
IV	If bearing housing requires cooling water, volume and pressure of cooling water is to be indicated in Technical Data Sheet.
V	Lubricating oil will be the responsibility of Gear Box manufacturer. Hence, manufacturer has to make arrangement of first fill of oil at installation and at commissioning stage. Quantity of oil and its grade is to be indicated in Drawing and Operation Manual.
E)	MATERIALS
I	Agitator components shall meet the requirements of the industry specification as listed for the material in the table as well as in the specification in the respective section.
II	A detail quality plan is to be submitted along with offer for all item.
III	Final acceptance of the quality plan will be approved by ultimate user during detailed engineering without any commercial implication. QAP should be as per the best practice followed internationally to avoid any conflict of interest.
F)	DRIVER (MOTOR)
I	Driver shall be sized to meet all specified operating conditions including bearing housing, seal, external gear box and coupling loss (if any).
II	Motor shall be able to accelerate to speed at reduced voltage and frequency as specified in "Site Power Supply Condition" as per Clause: 3.3.
III	It should meet the electrical specification (SECTION-I, SUBSECTION-C3).


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G)	GEAR BOX
I.	Gear box should be vertical flange mounted solid shaft type (Vertical Agitators), reducing speed type, specially designed for the requirement of Slurry mixing and to be manufactured by the Agitator supplier. Complete up-thrust and down-thrust, developed by Agitator shall be taken by thrust bearing housing of Gear Box. An auxiliary slow drive provision shall be provided in the Gear Box so that slurry is always kept in dynamic condition to avoid settling of slurry at bottom, in the event of Agitator is not operating at its rated speed. Rating of Gear box shall be at least 1.5 times the rated torque of Agitator. Gear box details are subject to customer approval during detailed engineering without any commercial implications.
II.	The reduction unit shall be procured from a reputed manufacturer and shall confirm to BS: 721 (latest edition)/AGMA/Equivalent specifications. The sub-vendor of the gear-box shall be approved by customer during contract execution.
III.	Gear drives shall have splash type oil lubrication. If oil pumps are used, they shall be removable for maintenance without disturbing the motor or drive housing.
IV.	The gear reduction unit shall always be provided with an oil drain, a breather and oil level gauge. The lubrication to be designed keeping in view that the temperature within the bearing should not exceed 85 Deg. C.
V.	-VOID-
VI.	The bidder shall provide an easily accessible oil level gauge and a dipstick that will indicate oil level under standstill and operating conditions.
H)	COUPLING & COUPLING GUARD
I.	Coupling and coupling guard should be supplied between driver and driven equipment.
II.	Coupling should be designed taking into consideration adequate service factor.
III.	Design rating of the coupling (excluding service factor) should be indicated in data sheet.
IV.	Coupling must be having locking screw so that it does not slide over shaft in due course operation.
V.	Vertical Agitators - Coupling between Motor and Gear Box, if applicable, shall be Spacer-type flexible coupling, made of Cast Iron. Spacer shall be of sufficient length so than Motor and Gear Box shall be able to run independently at no-load condition by detaching the respective coupling.
VI.	It is desirable that for servicing of seal, coupling half should not be removed. Coupling should be dynamically balanced to Gr: G6.3, ISO-1940. Any deviation to this requirement is subject to customer approval during detailed engineering based on applicable codes and standards to be furnished by the bidders.
VII.	Removable coupling guard shall conform to the requirements of all applicable national, industrial or statutory regulations.
I)	PLATE AND FASTENING BOLTS


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I.	Base plate shall be interpreted as the component of Agitator assembly through which the whole load will be transmitted to the Sole Plate/Nozzle over which the equipment will be mounted. The Base plate shall be fabricated with mild steel of structural quality (UTS=42N/sq. mm minimum) with anti-corrosive paint of sufficient dry-film thickness.		
II.	Base plate must have provision of leveling on its intended mounting place. Nozzle is not in the scope of supply of Agitator manufacturer. It should be noted that Nozzle will be rubber lined to prevent any leakage of corrosive gases.		
III.	Alignment between Gear Head Shaft and Agitator shaft shall be within the permissible limit of Gear Box. Similarly, misalignment between Motor shaft and Gear Box Shaft shall be within 0.050 micron (radial) and 2 degree (angular) or better as per requirement of Motor and Gear Box.		
IV.	Base plate with desired number of holes shall be provided by the bidder, will be machined on one side. Base Plate shall be welded to the structure after leveling, as recommended by Agitator manufacturer and rubber lining is completed before placing the equipment in its desired location.		
J)	OTHER COMPONENTS		
I	All fasteners used in wetted condition must comply to the material given in this specification so that even if it comes in contact with liquid by swelling of rubber, thread remains unaffected. Raw material of fastener must undergo Inter-granular Corrosion test as per ISO-3651, Part-1 for Nitric Acid test.		
II	Mounting flange dimensions shall be as per ASME B16.5 up to 600 Nb, ASME B 16.47 for more than 600 NB.		
III	Rubber Lining (As Applicable) <ol style="list-style-type: none"> Rubber lined surfaces shall utilize 6 mm nominal thickness chlorobutyl rubber. Areas of high wear (e.g. leading edges on impeller blades) shall have an additional 6 mm of rubber for abrasion protection. No field-applied linings are permitted except for file patch kits. 		
K)	GENERAL REQUIREMENT OF SIDE ENTRY AGITATORS:		
I.	All Agitators shall be designed for continuous operation.		
II.	VOID.		
III.	It should be of Flange mounted type.		
IV.	Nozzle size, on which Agitator shall be mounted, shall have enough opening to Insert rotating assembly from side. Bidder shall inform the required nozzle size. Further the mating flange shall be in the scope of the bidder.		
V.	The Bidder to consider Gypsum Sedimentation during stoppage of Agitator.		
VI.	VOID		


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L)	GENERAL REQUIREMENT OF TOP ENTRY AGITATORS IN OTHER SLURRY TANKS & DRAIN PITS:								
I.	All Agitators shall be designed for continuous operation.								
II.	VOID.								
III.	It should be roof mounted.								
IV.	Agitators shall be vertical mounted type and shall be driven by motor with reducing speed gear box of rigid type, solid shaft coupling between gear box and agitator and flexible coupling of spacer type between Motor and Gear Box. Both Gear Box and Motor should be vertically/horizontally flange mounted type with a common frame of the whole equipment. The entire thrust load of agitator should be transmitted to the thrust bearing of Gear box.								
V.	Nozzle size, on which Agitator shall be mounted, shall have enough opening to Insert rotating assembly from top. Bidder shall inform the required nozzle size. Further the mating flange shall be in the scope of the bidder.								
VI.	Cable entry to the Motor terminal box should preferably be from top when motor is vertically mounted at its position and it should be easily accessible.								
VII.	Impeller should be dynamically balanced to Gr: G16: ISO-1940 after rubber lining of shaft.								
VIII	In case Bidder provides a Vertical Agitator with hub design the same has to be of Alloy 926 or better material								
IX	Operation speed of the Agitator motor shall be at least 25% below the first critical speed.								
X	-VOID-								
XI	-VOID-								
4.3	MOTOR								
1	All AC motor shall be Squirrel cage induction motor and, shall be suitable for direct –on-line starting. Rating of the motor should of Type S1 (Continuously rated) as per ISO-60034, Part-1. Rating of motor must be selected with minimum margin (as per the below table) above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variation: <table border="0"> <tr> <td>Agitator Rated BKW</td> <td>Motor Margin</td> </tr> <tr> <td><22KW</td> <td>125% of Agitator Rated BKW</td> </tr> <tr> <td>22KW-55KW</td> <td>115% of Agitator Rated BKW</td> </tr> <tr> <td>>55KW</td> <td>110% of Agitator Rated BKW</td> </tr> </table>	Agitator Rated BKW	Motor Margin	<22KW	125% of Agitator Rated BKW	22KW-55KW	115% of Agitator Rated BKW	>55KW	110% of Agitator Rated BKW
Agitator Rated BKW	Motor Margin								
<22KW	125% of Agitator Rated BKW								
22KW-55KW	115% of Agitator Rated BKW								
>55KW	110% of Agitator Rated BKW								
2	It should meet the electrical specification (SECTION-I, SUBSECTION-C3).								
5	GENERAL REQUIREMENTS								
1	Metric unit shall be used in the drawings and in the any displays on the equipment's. Special attention should be taken that the unit of pressure shall be in dual scales of kPa and kg/cm ² (G). For instance, the pressure gauges should have dual unit's indication.								
2	Descriptions in the drawings, in the documents, and in the displays shall be in English								


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3	All rotating parts such as coupling shall be covered with suitable protective guards. Guards shall be easily removable type.
4	The equipment shall be designed to withstand the corrosive and moist environment in which these are proposed to operate.
5	Noise level produced by any rotating equipment individually or collectively shall not exceed 85 dB measured at a distance of 1.0 meters from the source in any direction and 1.5m above operating floor.
6	The overall vibration level shall be as per ISO 10816.
7	Suitable drain connections shall be provided.
8	The equipment shall be suitable for stable operation continuously.
9	Corrosion allowance: Corrosion allowance for entire equipment shall be in accordance with latest applicable Indian / International standard. Carbon steel shaft shall have a corrosion allowance of 6mm on its diameter. On other non-pressure carbon steel parts, a corrosion of 3mm shall be considered on each surface.
10	Unless otherwise specified, flanges shall be in accordance with ANSI B16.5 Class 150
11	Name plate: All equipment shall be provided with nameplates indicating the item number and service name. Name plates 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.
12	Rotation arrows shall be cast in or attached with stainless steel plate on each item of rotation equipment at a readily visible location.
13	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 minimum 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.
14	Skid Mount/Transportation: Equipment shall be fabricated as skid mount design as much as practical to minimize erection at the site.
15	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.
16	Bidder shall provide the necessary gaskets.
17	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.
18	Bidder to provide capacity of hoist required for material handling and the details of heaviest component to be handled. Bidder shall provide a typical arrangement/drawing of the handling arrangement.
19	The list of all Bought out items with makes and country of origin to be mentioned during detailed engineering and shall be subjected to BHEL/end customer approval.


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20	Cost towards the participation in discussions/meetings, providing technical assistance during technical discussions/meetings with customer for approval of drawing/documents etc. TA/DA, boarding and lodging to attend these meetings shall be borne by the bidder and shall be inclusive in Bidder quoted price.	
21	Material of construction for all equipment/components shall be subject to customer/ BHEL approval during detail engineering. Accordingly, bidder shall consider MOC for all equipment/component (complying tender specifications), as per best engineering practice, global standard and global references, in case no MOC is available in specs.	
22	Bidder to provide sub vendor list and Bidder shall strictly adhere to customer approved vendor list (reference list is included in SUB-SECTION-D, Annexure-I). In case bidder proposes an additional vendor for an item or vendor approval is required for any new item, acceptance shall be subject to approval by customer/ BHEL before placing order and bidder shall submit relevant documents to take up with customer for approval. Bidder shall submit relevant documents as per Sub-Supplier Questionnaire provided in referred Annexure.	
23	It shall be the complete responsibility of the successful bidder to obtain "Sub Vendor Approval" from BHEL / customer for all equipment's & components. Any delay in sub vendor's approval should not affect the project schedule.	
24	<p>The modalities of inspection (Stage, Final, In-process) shall be finalized during detail engineering after submission of quality assurance plan (QAP). It shall be reviewed by the end customer and BHEL. Bidder shall follow the procedures of inspection as per the approved QAP. Bidder has to submit the following documents along with inspection call and any other documents required as per approved QAP.</p> <ul style="list-style-type: none"> - Raw material inspection certificate - Internal test reports - Statutory certificates as required. - All inspection & testing shall be carried out based on the following documents: <ul style="list-style-type: none"> a. Relevant Standards b. Specifications c. Approved drawings d. Data Sheets e. Calibration certificate for all the measuring instruments 	
25	During detail engineering, bidder to strictly adhere to BHEL/customer drawing formats, document numbering, quality plan & FQP formats	
26	VOID.	
27	Complete detail engineering drawings, calculations, selection of components etc. shall be reviewed & subject to approval of BHEL/Customer during detail engineering	
28	Bidder shall furnish necessary inputs & drawings of all equipment in editable Auto CAD/ MS-Word /Excel format.	
29	During detail engineering, successful bidder shall ensure flow of drawings/documents as per schedule. Any comments from BHEL/Customer should be addressed timely by the bidder.	

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30	Bidder to note above mentioned points not exhaustive and any work /items required for completing the smooth operation and ensuring satisfactory running of the machines till final hand over to the end user shall also be in the scope of the bidder.
31	Bidder shall provide design support to assist the Purchaser in efficiently integrating the furnished equipment. Design support specifically includes: a) Bidder shall verify/ validate the number and location of agitators to keep material in suspension. b) Static and dynamic loading information and requirements for Agitator support design (applicable for top & side type)
32	Any other item required to meet the stipulations mentioned in GTR, GCC and SCC and relevant to Agitator package unless specifically excluded from scope of supply.
6	PACKING AND FORWARDING
1	Proper packing to be ensured. Indigenous Supply: Agitator & sub system assembly shall be wrapped in polythene bags & packed in a strong rigid wooden crate. Rain water should not enter into the Agitator internals during storage in the outer yard of power plant. Imported Supply: All imported supply should be packed as per Sea worthy packing standards as per Sub-Section D, Section-II. All imported items should have Sea worthy packing. Liberal packing materials and struts shall be provided to arrest rolling and to protect from transit damages.
2	Equipment and process materials shall be packed and semi-knocked down, to the extent possible, to facilitate handling and storage and to protect bearings and other machine surfaces from oxidation. Each container, box, crate or bundle shall be reinforced with steel strapping in such a manner that breaking of one strap will not cause complete failure of packaging. The packing shall be of best standard to withstand rough handling and to provide suitable protection from tropical weather while in transit and while awaiting erection at the site.
3	Equipment and materials in wooden cases or crates shall be properly cushioned to withstand the abuse of handling, transportation and storage. Packing shall include preservatives suitable to tropical conditions. All machine surfaces and bearings shall be coated with oxidation preventive compounds. All parts subject to damage when in contact with water shall be coated with suitable grease and wrapped in heavy asphalt or tar impregnated paper.
4	Crates and packing material used for shipping will become the property of end customer.
5	Packaging or shipping units shall be designed within the limitations of the unloading facilities of the receiving ports and the ship which will be used. It shall be the bidder's responsibility to investigate these limitations and to provide suitable packaging and shipping to permit transportation to site.
6	Packing (tare) shall be part of the equipment cost and shall not be subject to return. The packing should ensure integrity and cohesiveness of each delivery batch of equipment during transportation. In case of equipment assemblies and unit's delivery in the packing of glass, plastics or paper the specification of packing with the material and weight characteristics are to be indicated.


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7	<p>Each package should have the following inscriptions and signs stenciled with an indelible ink, legibly and clearly;</p> <ul style="list-style-type: none"> a. Destination b. Package Number c. Gross and Net Weight d. Dimensions e. Lifting places f. Handling marks and the following delivery marking
8	<p>Each package or shipping units shall be clearly marked or stenciled on at least two sides as per the dispatch instruction givens during the contract. In addition, each package or shipping unit shall have the symbol painted in red on at least two sides of the package, covering one fourth of the area of the side.</p>
9	<p>Each part of the equipment which is to be shipped as a separate piece or smaller parts packed within the same case shall be legibly marked to show the unit of which it is part, and match marked to show its relative position in the unit, to facilitate assembly in the field. Unit marks and match marks shall be made with steel stamps and with paint.</p>
10	<p>Each case shall contain a packing list showing the detailed contents of the package. When any technical documents are supplied together with the shipment of materials no single package shall contain more than one set of such documents. Shipping papers shall clearly indicate in which packages the technical documents are contained.</p>
11	<p>The case number shall be written in the form of a fraction, the numerator of which is the serial number of the case and the denominator the total number of cases in which a complete unit of equipment is packed.</p>
12	<p>Wherever necessary besides usual inscriptions the cases shall bear special indication such as “Top”, “Do not turn over”, “Care”, “Keep Dry” etc. as well as indication of the center of gravity (with red vertical lines) and places for attaching slings (with chain marks)</p>
13	<p>Marking for Safe handling: To ensure safe handling, packing case shall be marked to show the following:</p> <ul style="list-style-type: none"> a. Upright position b. Sling position and center of Gravity position c. Storage category d. Fragile components (to be marked properly with a clear warning for safe handling)
14	<p>Each crate or package is to contain a packing list in a waterproof envelope. All items are to be clearly marked for easy identification against the packing List. All cases, packages etc. are to be clearly marked on the outside to indicate the total weight where the weight is bearing and the correct position of the slings are to bear an identification mark relating them to the appropriate shipping documents. All stencil marks on the outside of cases are either to be made in waterproof material or protected by shellac or varnish to prevent obliteration in transit.</p>


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15	The packing slip shall contain the following information: - Customer name, Name of the equipment, Purchase Order number with Date, Address of the delivery site, Name and Address of the Sender, Serial Number of Agitator, and BHEL item Code, Gross Weight and Net weight of Supplied items.
16	Prior to transport from manufacturer's work to destination, components of the unit shall be completely cleaned to remove any foreign particles. Flange faces and other machined surfaces shall be protected by an easily removable rust preventive coating followed by suitable wrapping.
17	All necessary painting, corrosion protection & preservation measures shall be taken as specified in painting schedule. Supplier shall consider the coastal environment zone which is defined as "very severe" during final finishing/shipping.
18	Successful bidder shall furnish the detail packing /shipment box details with information like packing box size, type of packing, weight of each consignment, sequence no. of dispatch, no. of consignment for each deliverable item against each billing break up units/ billable blocks. Without these details the BBU shall not be approved during detail engineering.
19	All items/equipment shall be dispatched in properly packed condition (i.e. no item shall be dispatched in loose condition such that it becomes difficult to store/identify its location at site at a later stage).
20	Cases which cannot be marked as above shall have metal tags with the necessary markings on them. The metal tags shall be securely attached to the packages with strong steel binding wire. Each piece, Skid, Case or package shipped separately shall be labelled or tagged properly.
7	ERECTION, TESTING AND COMMISSIONING
1	The erection and commissioning of Agitators shall be done as per Erection Manual and check List to be provided by the bidder during detail engineering.
8	EXCLUSION
	NIL.
9	INSPECTION AND TESTING
1	The General inspection requirements to be considered are as below:
2	Bidder shall furnish written copies of shop production, fabrication and quality test procedures and drawings to be used on the Agitators for review by BHEL/end customer prior to manufacture.
3	The Bidder shall furnish performance test procedure along with standard. The test procedure will be reviewed and approved by the BHEL/customer.
4	Agitator manufacturer is to submit a test procedure and Quality Plan, clearly indicating that equipment will meet the desired parameter.


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5	Power consumption at motor terminal and vibration of equipment will be conducted at site. Vendor to indicate other material tests that are to be conducted as per their practice in their Quality plan.	
6	No liquid should enter the tube through any flange joint. "O"-ring used in the flange joint will deteriorate at a highly chlorinated and acidic environment of medium at a maximum operating temperature unless right quality of rubber is used. Hydrostatic testing of tube assembly is required at a pressure of twice that of maximum liquid column in any tank or 30m whichever is higher. The hydro test duration will be for a minimum of 1 hour to check sweating of any flange. Hydrostatic test is meant in part for a check of equipment joint at new condition only. It cannot be considered as a guarantee of functional objective of rubber used.	
7	<p>Mechanical Run Test (in air)</p> <p>Each Agitator unit shall be given a 4-hour mechanical run test in air at vendor's shop. Agitator unit shall be mounted in the same manner as it will operate in the field. During this test the record shall be made of:</p> <ol style="list-style-type: none"> Shaft run out at free end. Dynamic shaft deflection adjacent to the mechanical seal/packing/vapor seal. Gearbox oil temperature and temperature of bearing housing in stool. The temperature of the gear box oil shall not exceed ambient plus 40 Deg. C and that of bearing housing shall not exceed from room temperature plus 20 Deg. C after temperatures have stabilized. Bearing Housing vibration checks shall be carried out. Maximum acceptable vibration velocity shall be 6 mm/sec. Noise level shall be checked and shall be within the specified limits mentioned in the specification. Agitator shaft RPM and motor RPM. Check of satisfactory operation of shut off and retracting arrangement. <p>Please also refer serial no. 9 below.</p>	
8	<p>Mechanical Run Test (in water)</p> <p>Each agitator unit shall be given a load test in water at the vendor's shop. The duration of this test shall be 4 hours unless agreed otherwise between the Purchaser and the vendor. The following parameters shall be recorded during the test:</p> <ol style="list-style-type: none"> Dynamic shaft deflection adjacent to the mechanical seal/packing/vapor seal. Gear box bearing oil temperature and temperature of bearing housing in stool. The temperature of gear box oil shall not exceed ambient plus 40°C and that of bearing housing shall not exceed room temperature plus 20°C after the temperatures have stabilized. Bearing housing vibrations. Maximum acceptable vibration velocity is 6 mm/sec. Noise levels shall be checked and shall be within the specified limits mentioned in the specification. Electrical power input to the motor. Agitator shaft RPM and motor RPM. Check of satisfactory operation of shut off and retracting arrangement. 	


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	As a part of the Quality Assurance Plan, where possible as per facility available at bidder's work, bidder may demonstrate the power consumption also of each agitator at shop with the available fluid along with relevant calculation to establish the correlation with the slurry used for the project, apart from necessarily demonstrating power requirement at site. Also, Please refer sl. no 9 below.
9	In case of any constraints in carrying out shop tests indicated at S No. 7 & 8 above, the Mechanical run tests for agitators shall be carried out with air/water at shop along with other test requirement in line with the QAP to be approved by customer during detail engineering.
9A	Acceptance Test (at Site) After the Agitator has been installed at site and is ready for test, Agitator supplier shall depute his representative to supervise the site acceptance test.
10	DYNAMICS
10.1	CRITICAL SPEED
10.1.1	Operation speed of the Agitator motor shall be at least 25% below the first critical speed
10.1.2	Additional to the requirement of the critical speed of Agitator, as specified above. Agitator manufacturer is to analyze the torsional critical speed of combined system of Agitator, Gear Box and Motor to establish there is a separation margin of minimum 20% between the torsional critical speed (dry/wet) and any operating speed.
10.2	VIBRATION SEVERITY
10.2.1	During performance test, unfiltered vibration measurements shall be made with running of Agitator in Air. Measurement shall be taken on the Gear Box thrust bearing housings as well in motor top.
10.2.2	Guaranteed Site vibration of the equipment on its own pedestal, at commissioning with normal level of liquid and with maximum liquid at respective tank, Vibration limit at site will be as per ISO-10816 and 1.5-2.3mm/sec even if Motor rating falls below 15kw. Any deviation to this requirement is subject to customer approval during detailed engineering based on applicable codes and standards to be furnished by the bidders
10.2.3	Vibration measurements of bearing housing shall be made in root mean square (RMS) velocity.
10.2.4	Vibration levels measured on the non-rotating parts shall not exceed the zone limit "B" as defined in ISO 10816 at steady conditions and shall not exceed the zone limit "C" as defined in ISO 10816 at transient conditions.
11	For surfaces with rubber lining, welding shall be visually inspected to verify the absence of rough area and unacceptable transition between surfaces which prevent the adequate adherence of rubber. The acceptance criteria shall be as per latest standard.
12	For surfaces with rubber lining, degree of cleaning shall be visually checked before the application of the coating. There must be no area with oxidation, dirt or partially or generalized corrosion defects.


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13	Test certificates shall be issued for each lot of raw material used in the coating, corresponding to specific weight and traction resistance.
14	For surfaces with rubber lining, adherence test shall be conducted on production samples. Adherence test shall be conducted on the actual surface through hammering. In order to verify the absence of air packets (or) surface without adherence.
15	For surfaces with rubber lining, Coating thickness shall be checked at 100%. A High voltage porosity test will be conducted on 100 % of the coated surface.
16	Out of all Agitators One Number of each type will be inspected at the Bidder's works before dispatch or where the test facilities are available.
17	The Bidder shall conduct performance test for the remaining Agitators and submit the reports.
18	Contract shaft mechanical seals shall be used during shop tests, unless the seal design is unsuitable for the shop-test condition, if applicable.
19	Agitators shall not be released for shipment, until shop tests data and performance tests curves have been approved by Owner.
20	Bidder should furnish performance guarantee as per applicable standard guarantee for the design, manufacture, material and safe operation of the equipment's.
21	Bidder to arrange all calibrated gauges, Instruments during inspection.
22	Mechanical running and the performance test shall be carried out. Bidder to arrange Motor of same / higher rating for the shop test and inspection.
23	All testing requirement/certificates shall be in line with QAP to be approved by customer during detailed engineering.
10	PAINTING
1	Painting details for agitator support: - Please refer painting specification (SECTION-I, SUB-SECTION-C2C).
2	Rust preventive paint after inspection at shop floor before dispatch shall be in bidder's scope.
3	Corrosion protection, coating and galvanizing, painting shall be taken care by the bidder. Bidder shall submit the painting scheme during detail engineering. in line with the specification and shall be subject to approval of BHEL / End Customer.
11	SPARES, TOOLS & TACKLES
1	Bidder shall supply a set of special tools and tackles required either for erection or operation or maintenance of the agitator units. A list of such tools shall be submitted by bidder along with the offer.

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2	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 (SECTION-III, Annexure-6).	
11.1	START UP & COMMISSIONING SPARES	
	Start-up & Commissioning Spares shall be part of the main supply of the Agitators. 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 Agitator 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. The List of such spares to be provided during bidding stage (SECTION-III Annexure-7).	
11.2	RECOMMENDED SPARES	
	Bidders shall also furnish the recommended spares list along with the offer required for 3 years of normal operation of the plant and should be independent of the list of the mandatory spares. Prices of recommended spares will not be used for evaluation of the bids.	
11.3	MANDATORY SPARES:	
	<p>a) Bidder to quote for the mandatory spares as per the Mandatory Spare list (SECTION-I, SUB-SECTION-D Annexure-IX).</p> <p>b) Bidder shall quote for the “Mandatory Spares Part List”, and it will be considered for L1 evaluation. Mandatory spare parts items shall be handed over separately and shall not be mixed with the supply of the main equipment parts. Spares shall be sent in pre-decided lots in containers/secure boxes. All boxes/containers are to be distinctly marked in red color with boldly written “S” mark on each face of the containers. Spares shall not be dispatched before dispatch of corresponding main equipment’s. Each item shall be labelled in English and be packed against damage and sealed to prevent deterioration from corrosion.</p> <p>c) All spares supplied under this contract shall be strictly inter-changeable with the parts for which they are intended for replacements. All the mandatory spares shall be manufactured along with the main equipment components as a continuous operation as per same specification and quality plan.</p>	

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12	FIRST FILL OF CONSUMABLES
I	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.
II	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.
III	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 end customer/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.
13	BID EVALUATION CRITERIA FOR POWER CONSUMPTION:
1.	POWER GUARANTEE Bidder to specify the total guaranteed power per Agitators operating at the rated capacity in their offer.
2.	BID EVALUATION CRITERIA FOR POWER CONSUMPTION: Refer Annexure X, Sub Section D, Section-I.
14	LIQUIDATED DAMAGES FOR POWER CONSUMPTION
	Refer Annexure X, Sub Section D, Section-I.
15	PERFORMANCE GUARANTEE

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- a) All performance tests for Agitators shall be carried out in accordance with any latest international codes/standards.
- b) Bidder shall furnish Performance guarantee for the design, manufacture, material, safe and trouble-free operation of the Agitators and its accessories
- c) The Bidder shall ensure a design of the equipment to achieve an average target availability of 98% for 120 days and average target availability of 95% for 1 year.
- d) Noise level ≤ 85 dB (A) at 1m horizontal distance from equipment/enclosures and 1.5m above operating floor is to be guaranteed.
- e) Vibration levels measured on the non-rotating parts shall not exceed the zone limit "B" as defined in ISO 10816 at steady conditions and shall not exceed the zone limit "C" as defined in ISO 10816 at transient conditions.
- f) Life of Agitator components/parts from the date of commissioning for continuous operation shall be guaranteed for 24 months.
- g) Acceptance tests to be carried out as per the procedure defined by the bidder which shall be submitted for BHEL/ end customer approval.
- h) In the event that the performance test is unsuccessful, bidder shall take necessary remedial action at his cost and the performance test shall be repeated.


For additional details of performance guarantee please refer 'functional guarantee' under Sub-section C2-B, Section-I.

16	DOCUMENTATION
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A	DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER
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The Bidder shall submit all documents, drawings, diagrams and all such information, which are necessary to fully understand the offer for techno – commercial Offer. Vendors are requested to comply with above in all respect. List of such documents have been indicated in (SECTION-II Annexure-1).

B	DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT
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	<p>a) The Successful bidder shall submit necessary data, documents and drawings for review, approval as specified in this specification. Drawings that are reviewed by the end customer/ BHEL, will be returned to bidder with a transmittal letter with any comments and / or questions marked on the drawings or noted in the letter. All comments and questions must be resolved before a resubmission of drawings / documents. If the design has not developed enough to resolve some of the comments or questions, bidder shall place a “hold” on those items or areas of design. End customer/ BHEL reserves the right to return drawings unprocessed to bidder if there exists any evidence that bidder has not acknowledged all comments and questions.</p> <p>b) All necessary GA drawings, sections, sub-assembly drawings, specifications of main and sub components and necessary set of operation & maintenance manual as asked by end customer must be furnished by bidder in soft and hard copy forms. For all document’s softcopy format shall be searchable pdf, however in addition all drawings, diagrams shall be supplied in ACAD or other editable format and all lists in Excel format. Further break up of technical documents will be discussed during finalization of the purchase contract.</p> <p>c) All documents in hard and soft form are to be submitted in the English language. Electronic Copies shall be submitted in primary original data format (e.g. DOC, XLS, DWG) as well as in a printable non-proprietary document format (e.g. PDF). Especially P&IDs shall be submitted as DWG files and PDF files. Bidder to ensure submission of hard copies as per end customer requirement for all engineering drg/doc and for all subsequent revisions along with a soft copy through email to concerned project team.</p> <p>d) The list of such drawing/documents have been indicated in SECTION-I, SUB-SECTION-D Annexure-IV.</p>
17	LIST OF DRAWINGS AND SCHEDULES BY BHEL
I	The document specified in Sub-Section-D of Section-I are being provided for estimation and calculation purpose of the bidder.

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SPECIFICATION NO. PE-TS-491-167-A001

SECTION –I, SUB SECTION –C1C

REVISION 00

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SUB SECTION-C1C

SPECIFIC TECHNICAL REQUIREMENTS – RUBBER LINING



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1.0 SCOPE OF WORKS

- 1.1 Design, manufacture, testing and supply of rubber lining material for the duty condition for FGD Tanks as specified in **Annexure- III (Tank schedule)**, Sub Section-D, Section-I.
- 1.2 Erection and Commission of Rubber lining, delivery of material at site, surface preparation for lining surfaces, lining the surface to the satisfaction of the customer shall be under bidder's scope, cost for Erection and Commission shall be included in the offer.
- 1.3 Ten (10) copies of Operation manuals containing all details of reference drawings and technical data shall be furnished by the Bidder.

2.0 SURFACE PREPARATION

- 2.1 The Tanks surface to be lined should be blasted to a bright grey metal finish (Sa 2½ requirement), free from rust, weld marks, oil and any other foreign matter. The blasting is carried out with the help of dry grit (copper sludge)/Sand under dry air pressure of 7 kg/cm² by Compressor. Surface roughness shall be 50-60 Microns.
- 2.2 After blast cleaning, blasted surface will be applied by surface protecting primer to prevent the corrosion. After 100% blasting of the particular Tank is completed, the surface is cleaned by appropriate solvent, so as to see that all the small dust particles are removed. Sharp corner shall be suitable rounded off. Surface should not have any sharp notch.
- 2.3 After this procedure suitable bonding agent and 3 to 4 coating of the specially formulated rubber adhesive should be applied for proper bonding of the Rubber Sheets to be lined.
- 2.4 Compressor and any other facilities required for grit/shot blasting shall be arranged by vendor. Any hoses provided in the compressed air line shall be tested with air before commencement of grit blasting job.
- 2.5 The grit/shot blasting machine shall be provided with safety valve (safe trip) as a protection against over pressure.
- 2.6 Scaffolding shall be done by the vendor. Any scaffolding provided by the vendor shall be of steel only.

3.0 GUIDELINES FOR DESIGNING AND FABRICATION OF STEEL CONSTRUCTIONS FOR RUBBER LINING:

Please refer Section-II, Sub-Section-A

4.0 RUBBER LINING

- 4.1 The lining shall completely cover the roof, sides and internals of Slurry Tanks, support angle, insert plates, openings, Man Hole / Inspection / Flange openings. etc.,
- 4.2 The rubber used for the lining of the tank is given below:

Sl. No	Tank	Rubber Lining details of interior surface / Painting details of interior surface



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1	Auxiliary absorbent tank, Limestone slurry storage Tank and Primary hydro cyclone Tank.	Chlorobutyl/Bromobutyl rubber lining with Shore A hardness as 55±5 and min 5 mm thickness.
2	Process water Tank, Belt Filter Wash Tank and Clarified (Cake wash) Water Tank.	Epoxy lining of minimum 150 micron thickness (3 coats of 50 micron each)

4.3 After Rubber sheet applied on the surface, rubber sheets should be systematically pressed to the metal surface by the help of mechanical tools like Rubber Rollers and metal thin rollers to remove the air between metal and rubber sheet. All rubber joints are properly overlapped by 25 to 35 mm wide tapered cut rubber sheet. All the joints will be covered by 75 mm X 1.5 - 1.7 mm thick rubber strip.

4.4 Vendor shall specify the shelf life of the rubber material being supplied and shall furnish the storage methods to be followed at site to ensure that the rubber material shall not be spoilt during storage.


4.5 Vendor shall submit the surface preparation and lining procedure to the purchaser for approval. The lining work shall start only after obtaining approval from Purchaser.

5.0 INSPECTION AND TESTING OF RUBBER LINING

- | | | | |
|----|---|---|--|
| 1 | Ageing Test | : | 70°C for 24 hrs. (IS: 3400 Pt.4)
Change in Tensile Strength: ± 5%
Elongation at break: ± 10% |
| 2 | Abrasion Test | : | Wt. loss – Max. 25% |
| 3 | Tensile Strength | : | 35 kg/cm ² (min) for Bromo Butyl and
40 kg/cm ² (min) for Chloro Butyl Rubber |
| 4 | Elongation at break | : | ≥ 300% minimum for 4mm thk rubber specimen |
| 5 | Peeling strength | : | ≥ 3 N/mm |
| 6 | Hardness | : | 55 ± 5° Shore A |
| 7 | Spark Test | : | 1.5 KV/ mm |
| 8 | Lining shall be visually inspected to ensure free from poorly weed out fibers, entrapped air and exposed fires. Defects are to be repaired by sanding a generous area around the defected portion and applying a layer of rubber material. | | |
| 9 | Spark test shall be carried out at appropriate areas in the presence of Purchaser. Vendor should conduct test as per relevant standards. | | |
| 10 | After installation, the Rubber lining shall be subjected to testing at site as per relevant standards. If the performance is found not to meet the requirements as specified, the Rubber lining shall be rectified or replaced by the Vendor without any extra cost to the Purchaser. | | |

6.0 FINISHING & INTERNAL TESTING

- 6.1 Rubber surface of all flanges and manhole of Equipment will be finished by the mechanical tools to get leakage free surface during commissioning.

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- 6.2 After above finishing, 100% testing will be carried out for continuity by high frequency high voltage spark tester. If there is any puncture, they are checked and rectified as per the standard procedure of repair (Clause 6.1) as mentioned in procedure.

7.0 REPAIRING PROCEDURE

- 7.1 Faulty spots on the rubber lining are cut off down to be substrate and the seams of the remaining rubber are beveled.
- 7.2 Rubber sheet with a broad bevel cut is glued on the substrate laid bare.
- 7.3 On spots to be repaired of a diameter < 300 mm, a second layer of Rubber sheet is glued covering the seams of the first layer.
- 7.4 Several spots to be repaired in a small area are jointly covered with a second layer of Rubber sheet.

8.0 PERFORMANCE GUARANTEE

The lining material shall be guaranteed for **an uninterrupted minimum life of 25000 hrs.** Performance parameters to be guaranteed by the vendor and tolerances permitted shall be as indicated in the data sheet. Rubber lining or any portion thereof is liable for rejection, if it fails to give any of the guaranteed performance parameters. The lining should be guaranteed for faultless material and workmanship. During Guarantee period any defects noticed due to faulty material and workmanship, shall be rectified by vendor free of cost.

9.0 PACKING

- 9.1 The part items of the Rubber lining should be identified by Tag numbers and should be packed as to minimize the possibility of damage during storage or transit. The packing should be suitable for tropical conditions.
- 9.2 Please refer **Sub Section- E, SECTION – II** for Packing Procedure.

10. DOCUMENTATION

DATA TO BE FURNISHED BY THE VENDOR AFTER RECEIPT OF PURCHASE ORDER:

- 10.1 List of Drawing and documents to be submitted for review, approval and information with submission dates.
- 10.2 Quality Assurance Plan to be submitted for approval.
- 10.3 Detailed dimensional General Arrangement drawing of the lining surfaces.
- 10.4 Document containing all the design data and information about the material, scope of work and weight of the material supply, Packing procedure etc.
- 10.5 Installation, operation and maintenance manual.
- 10.6 Surface preparation procedures.

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SUB SECTION-C1-D

SPECIFIC TECHNICAL REQUIREMENTS – GLASS FLAKE LINING



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1.0 INTENT OF SPECIFICATION

- a) This Specification defines the minimum requirements of glass flake lining of Slurry Tanks/drain sumps in the Flue Gas Desulphurization (FGD) plant.
- b) Tanks/Sumps to be lined contain Limestone Slurry/Gypsum Slurry. Slurry details are given in **Annexure- III (Tank schedule), Sub Section-D, Section-I**. The glass flake lining shall offer better resistance to corrosion/erosion and shall be based on Vinyl ester resin. Thickness of glass flake lining required is 3 mm thk.
- c) This specification covers the general design, selection of suitable glass flake material/resin, manufacture, shop inspection (As per latest applicable statutes, regulation and safety codes in the locality where the lining is to be carried out) and delivery at site, surface preparation of lining surface, lining the surface to the satisfaction of the customer, inspection of the lining at site, handling over to the ultimate customer.
- d) Compliance to this specification shall not relieve the vendor of the responsibility of furnishing glass flake lining materials of proper design, materials and workmanship to meet the specified requirements.

2.0 CODES AND STANDARDS:

The glass flake lining shall conform to the latest version of Indian/British/American/International Standards. Nothing in this specification shall construe to relieve the contractor of the required statutory responsibility. The Glass Flake Lining material shall be designed for the corrosion protection of the Slurry tank/drain sumps. The lining shall be glass flake filled vinyl ester-based coating system. Only Proven material has to be offered by the bidder. The reference standard are given below:

STANDARD	DESCRIPTION
ASTM D 4285	Standard Test Method for Indicating Oil or Water in Compressed Air
ASTM D 4541	Standard Test Method for Pull-Off Strength of Coating Using Portable Adhesion Testers
ASTM E 337	Standard test Method for Relative Humidity by Wet and Dry Bulb Psychrometer
ASTM D 4618	Standard Specification for Design and Fabrication of Flue Gas Desulfurization System Components for Protective Lining Application
ASTM D 5162	Practice for Discontinuity (Holiday) Testing of Non-Conductive Protective Coating on Metallic Substrates
NACE Standard RP0178-2003	Fabrication Details, Surface Finish Requirements, and Proper Design Considerations for Tanks and Vessels to be lined for Immersion Service
ISO 8501-1, 1988	Preparation of Steel Substrates Before Application of Paints and Related Products - Visual Assessment of Surface Cleanliness
SSPC"PA2	Measurement of Dry Paint Thickness with Magnetic Gauges



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3.0 SCOPE OF WORKS

- a) Supply of Vinyl ester based glass flake lining of minimum 3 mm thickness, storage, preparation of the surfaces for lining at site. All equipments required for lining shall be arranged by the lining vendor.
- b) Erection and Commissioning of the glass flake lining as per specification. Lining of the internal surfaces of slurry tanks and drain sumps to the satisfaction of the customer and testing the lined surface for proper adhesion, complete coverage and intactness with the base material/surface shall be under bidder's scope.
- c) To install the linings, full scaffolding access shall be provided to reach the internal walls and the entire area. Scaffold shall be properly erected with full planking in all work areas. Scaffolding shall not contact wall surfaces in work areas during lining application and surface preparation
- d) The execution of the surface preparation and lining shall be carefully planned in stages to obtain optimum lining quality with freedom from contamination and overspray or damage to lined surfaces from preparation in adjacent areas. Surface preparation will commence from the top and proceed progressively to the wall base and floor.
- e) Lining and preparation works shall be staggered or proceed progressively in order to meet cleanliness requirements or overcoating times indicated in this specification.
- f) Air-Compressor, Airless Spray pumps, hopper, blasting hose, lining hose, spray tip, blasting gun, spray gun and other equipment for blasting and spray application has to be arranged by lining vendor. Any scaffolding shall be made of Steel only.
- g) 10 copies of Operation and Maintenance Manuals containing all details of reference drawings and technical data shall be furnished by the Bidder.

4.0 VINYL ESTER BASED GLASS FLAKE LINING

4.1 For slurry tanks, the lining shall completely cover the roof, shell plates, support angle, Man Holes, Flanges, internal piping, baffle plates and any other component which is in contact with slurry. For drain sumps, lining shall cover all internal walls, bottom of sump and any other component which is in direct contact with slurry.

4.2 The glass flake lining used for the lining of the tanks/sumps is given as below:

Sl. No	Tanks/Sumps	Lining details of interior surface
1	Waste water Tank, Secondary Hydro cyclone feed Tank and Filtrate water Tank.	Vinyl ester-based Glass Flake lining of min 3 mm thickness.
2	Absorber Area drain sump (2 nos) and Gypsum Area drain sump (1no)	Polypropylene Homogeneous Grade (PPH) minimum 4 mm thk



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		plus 2mm FRV (fiberglass with vinyl Ester resin) or Acid / Alkali Resistant (AR) Tiles. The minimum life of lining or AR Tiles shall not be less than 5 years.
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5.0 ATMOSPHERIC CONDITION REQUIREMENTS

This section deals with the atmospheric condition requirement to be checked while undertaking the Glass Flake Lining at site.

1. Blasting or Coating shall not be applied if following conditions prevail.
 - When temperature of the surface to be coated is less than 3°C above the dew point, or the relative humidity is higher than 85%.
 - When the base metal temperature is greater than 60°C.
 - When the atmospheric temperature is below 4°C.
 - When there is, in the opinion of lining Contractor, the likely hood of an unfavourable change in the weather condition within 2 hours after coating.
 - When there is deposition of moisture in the form of rain or condensation.
2. Humidity shall be calculated by bidder using whirling hygrometer whose thermometers are calibrated.
3. Surface temperature shall be measured using suitable temperature gauge and calibration certificate of the same shall be provided by bidder.
4. Record will be maintained throughout the execution period. Readings shall be taken once in every 4 hours up to the time work is in progress. The frequency of reading should be increased during adverse weather conditions.
5. While working in unfavourable weather conditions (like monsoons or winters or if provided for in the contract or in large confined spaces where blasting and priming of the entire surface cannot be completed in one day operation, use of dehumidifier shall be resorted to. The dehumidification equipment will have to be maintained in such a way that the humidity is around 65% -75% inside the sump/tank at all times during the work. No flash rusting of the blast surface should take place till the time it receives a primer coat.
6. Where dehumidification equipment is to be used, the humidity readings are to be taken inside and outside the equipments to be coated.
7. Dehumidification equipment may not be necessary for contained space working if work is done at near ideal atmospheric conditions as described above.
8. In cases where dehumidification is not possible, alternate methods of warming up the work front like use of halogen lights, room heaters are to be adopted.



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9. Humidity is to be taken at the location where the blasting coating operations taking place.

6.0 PRELIMINARY CHECK REQUIREMENTS

This section deals with the preliminary check requirements to be done while doing the lining work.

6.1 CHLORIDE CONTAMINATION TEST:

The 2% ferricyanide paper method will generally be used to determine the chloride contamination as described below:

1. Apply de-mineralized water on approximate 12 cm² area of substrate and wait for 3 to 4 minutes.
2. Remove excess moisture by patting the substrate with clean lint free cloth.
3. Press a ferricyanide paper of approximate 12 cm² area against the substrate for approximately 5 seconds and remove the paper.
4. Total absence of blue spots on paper indicates the substrate is free from soluble salts
5. Light speckling paper indicates the substrate has still contamination but it is under the acceptance level. The component should be released for further process.
6. Large blue spots on the paper indicate the substrate is heavily contaminated.
7. In this case the following procedure to be done before coating.
 - 7.1.1. Pressures wash the substrate with copious amount of town water.
 - 7.1.2. Dry the substrate completely.
 - 7.1.3. Re-blasts the surface.
 - 7.1.4. Follow the salt contamination checking procedure again till you get the desired results.

8. The Ferricyanide papers should be stored by vendor in air tight container before and after use and the shelf life of Ferricyanide paper shall be one month.

6.2 ABRASIVE DRYNESS CHECK:

The abrasive to be used will be checked for dryness by taking a small quantity of abrasive on a filter /tissue paper and checking of traces of moisture absorbed in the filter/tissue paper. Frequency of test shall be once in day prior to blasting operation.

6.3 COMPRESSED AIR DRYNESS CHECK:

Compressed air to be used for blasting shall be free from oil & moisture and shall be tested adopting “Blotter Test” by vendor. A piece of blasting Paper will be held in front of blast hose nozzle to check for traces of oil/moisture captured by the blotting Paper. Frequency of test shall be once in day prior to blasting operation.

7.0 SURFACE PREPARATION

This section deals with the methods of surface preparation before coating application

7.1 MASKING:



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- a. Bidder to ensure that areas not being coated are fully and adequately masked.
- b. Bidder to ensure that stud holes, dowel/oil ways etc. are suitably masked or plugged to prevent ingress of blasting abrasives.

7.2 SURFACE PREPARATION METHODS:

The method of surface preparation dry abrasive manual blasting shall be done as follows:

- a. Surface to be coated shall be abrasive blasted. Before this operation, removal of existing coating to be carried out by chipping, grinding or by other suitable means. The walls of the tanks are painted with min 60 μ DFT of Red Oxide Phosphate (rust proof primer), which is to be removed by vendor during blasting. Clean & dry Copper Slag Abrasive shall be used for ferrous base substrate.
- b. The minimum recommended compressed air required for Blasting shall be 7.0 m³/min at 6 kg/cm² pressure. NACE No.1/SSPC-SP-5 equivalent to SA 2½ of Swedish Standard blast profile (75 to 100 Microns) to be followed for cleaning the surface.
- c. The blasted surface shall be cleaned with dry compressed air/vacuum cleaner or with clean brush so that there is no presence of Dust & other foreign material. The surface will be then checked for chloride contamination (Refer Clause.6.1 for Chloride contamination check procedure). Vendor to ensure that the blasted surface is free from chloride contamination
- d. When cleanliness and blast profile are acceptable, the masking tape adjacent to the area to be coated shall be peeled back to prevent overlap and subsequent edge contamination.
- e. If the blasted surface has not been primed within specified time or if there is any previous visible sign of blast condition change then the surface shall be checked for metallic salt contamination and shall be reblasted. Where large areas are required to be blasted in a day, blasting shall be carried out from morning to evening ensuring weather condition. This shall be followed by a light sweep blast of the entire area, before priming. The blast cleaned surface shall be blown off with dry oil free compressed air or vacuum cleaned. A cell tape shall be thoroughly pasted to the cleaned surfaces. The tape shall be removed after a minute to check presence of dust if any. Comparator shall be used by vendor for checking the blast profile.

8.0 COATING APPLICATION

This section deals with the methods & requirements of coating application.

8.1 MIXING

- a. All coating material tins shall be individually stirred thoroughly to obtain a homogenous consistency.
- b. While doing spray application, the tins which come in pre-measured kits will be fully mixed individually using a pneumatic stirrer. While doing hand application only small batches of 1 Kg. capacity shall be taken. Here the mixing will be done by using a metal spatula.



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- c. The mixing ratios as specified in the respective data sheet will be strictly adhered to. The base will be weighed out in kgs using mechanical weighing machines calibrated at site using any standard factory packed commercial product available freely in the market. The catalyst will be measured out in ML using marked syringes or measuring cylinders.

8.2 APPLICATION PROCESS

- a. The preparation and application of coating is done as per relevant product data sheet. Reference will be made to product datasheet or where appropriate, contract specifications for carrying out coating.
- b. Coating in confined spaces should be done when the ambient temperature is low to avoid excess build up of styrene fumes.
- c. The entire thickness will be built in multiple coating.
- d. Each coat will consist of minimum two passes of wet on wet in perpendicular directions.
- e. The Dry film thickness will built of each coat will be checked and recorded.
- f. All the other people working with the paint will be provided with eye splash goggles and masks.
- g. Glass flake lining material shall be chosen considering the slurry conditions given in Tanks' schedule.
- h. Minimum and maximum intercoat intervals are as follows.
 - i. For primer coat -At 20°C - minimum 2 hours, maximum 14 hours.
 - ii. For build-up coats-minimum tack free of previous coat, maximum 3 days.
- i. Primer coat shall be of 75-100 µm thickness
- j. Built up Coat shall be of 3000-3100 µm in multiple coats.
- k. Total System DFT: 3000 microns approx.
- l. All weld joints phase transition joints will receive a stripe coat by brush in the same sequence of coating on the shell.

8.3 CURING & FINISH

a. Curing:

The completed linings shall be allowed to cure for a minimum of 48 hrs at 30°C prior to being placed in service. However, curing time shall be as per the datasheet provided by vendor for a proven material.

b. Finish:

It is to be noted that the coating will follow the profile of substrate. Any unevenness or other defects in the substrate may be reflected in the finish coating also. The finished coating shall have a matt/semi-glossy finish. A few local paint sag marks will not affect performance of coating and cannot be completely avoided. Hence this is permitted.

9.0 INSPECTION AND TESTING OF GLASS FLAKE LINING

After the completion of lining, the following tests shall be conducted by the vendor to assess the quality of glass flake lined surfaces.

- a. Lining shall be visually inspected to ensure that it shall be free from poor weed out fibers, entrapped air and exposed fires. The Glass flake lining shall also be subjected to testing at site as per relevant standards.
- b. Testing of coatings is normally carried out as soon as they are sufficiently cured to give true thickness & to withstand damage by the test equipment. If defects are found, repair will be carried out as per clause 10.0



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- c. Spark test shall be carried out at appropriate areas in the presence of Purchaser. Vendor should conduct holiday test as per relevant standards. If the performance is found not to meet the requirements as specified, the Glass flake lining shall be rectified or replaced by the Vendor without any additional cost to the Purchaser.
- d. Proper documentation with details of tests conducted by the vendor for evaluation of glass flake lining shall be submitted to the purchaser.
- e. Detailed QAP of glass flake lining shall be submitted by vendor to BHEL during detailed engineering for approval. Any comments given by BHEL/Customer shall be incorporated/complied by vendor without any commercial implication to BHEL.

10.0 REPAIRING PROCEDURE FOR GLASS FLAKE COATING

- a. If the exposed or damaged surface is less than 10cm², then such repair can be carried out without grit blasting. Any area in excess of this amount should be grit blasted using a vacuum blaster where possible.
- b. In case of damage area less than 10cm², then it can be repaired as following.
 - i. De-contaminate surrounding area by using a suitable solvent such as methylated spirit, acetone, xylene etc. After washing clean and allow solvent to evaporate.
 - ii. Roughen up exposed metal & clean using rotary wire brush or a coarse emery paper with at least 60 grade grit. Brush away residues then further roughen surface of the existing coating up to 100 mm away from the damaged area. Brush away residues & ensure the whole area is clean.
 - iii. Apply a thin coat of material to the surface of the exposed metal only taking care not to cover more than a few millimetres of the existing coating. Allow this freshly applied material to become tack-free.
 - iv. Brush styrene monomer over the whole surface to be repaired (i.e. the whole area roughened by emery) & allow to evaporate from the surface.
 - v. Apply at least 2 main coats material over the treated area taking care not to brush on to any roughened or contaminated areas. The Glass flake should be allowed to harden sufficiently to bear the weight of next coat before application of further coats. However, it does not need to be tack-free between coats.

11.0 PERFORMANCE GUARANTEE

The lining shall be guaranteed for uninterrupted minimum life of 25,000 hrs. Performance parameters to be guaranteed by the vendor and tolerances permitted shall be as indicated in the data sheet. Glass Flake lining or any portion thereof is liable for rejection, if it fails to give any of the guaranteed performance parameters. During Guarantee period any defects noticed due to faulty material and workmanship, shall be rectified by vendor free of cost.

12.0 PACKING

The packing should be suitable for tropical conditions. Vendor shall make arrangements for storing the Glass flake lining materials in AC containers at site.

13.0 DOCUMENTATION

DATA TO BE FURNISHED BY THE VENDOR AFTER RECEIPT OF PURCHASE ORDER:

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- 13.1 List of Drawing and documents to be submitted for review, approval and information with submission dates.
- 13.2 Catalogue/Datasheets for the Vinyl ester-based Glass Flake Lining material
- 13.3 Detailed dimensional drawing of the lining surfaces indicating the design data and information about the material, scope of work and weight of the material supply etc.
- 13.4 Surface preparation and Lining procedures
- 13.5 Manufacturing Quality Assurance Plan for Glass flake material and adhesive to be submitted for approval.
- 13.6 Repair and rectification procedure for Glass Flake lining
- 13.7 Installation, Operation and maintenance manual.

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CUSTOMER SPECIFICATION

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PROJECT SPECIFIC REQUIREMENT

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	and shall be proven in similar application.		
9.06.00	The pumps shall not be supported below the base plate level for easy withdrawal without entering the sump.		
10.00.00	SLURRY & PROCESS WATER TANKS		
10.01.00	<p>All the slurry tanks (Slurry Tanks, Filtrate Tank, Secondary hydro cyclone feed tank, vacuum receiver tank, Waste water Tank, Lime Neutralization tanks etc.) shall be designed, fabricated, erected and tested in accordance with the IS:803, latest edition. Additional Corrosion allowance of 1.5 mm 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 the following:</p> <p>Wastewater tank, Filtrate tank, Secondary hydro cyclone feed tank: Vinyl Ester based flake glass lining/ Polymeric Epoxy of minimum 3 mm thickness.</p> <p>Slurry tanks: Replaceable Chlorobutyl/ Bromobutyl rubber lining of minimum 5 mm thickness</p> <p>The outside surface of the tanks shall be coated with paint as approved by the Employer.</p>		
11.00.00	AGITATORS		
11.01.00	Agitators shall be supplied in tanks and vessels to prevent caking and settlement of particles out of the slurry, e.g. in the absorber vessel, limestone mill recycle tanks, limestone slurry tank, Auxiliary Absorbent tank, and sumps etc.		
11.02.00	All agitators shall be designed for continuous operation unless otherwise specified. Horizontal agitators shall be used for Absorber. Vertical agitators can also be used for Absorber, if it is only the standard & proven practice of the Contractor for the offered Absorber design. In other vessels and tanks vertical agitators are also acceptable if they are of proven make and the Bidders standard practice which can be proven by means of suitable references. The design of the agitators shall be of proven type.		
11.03.00	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 (for side entry agitators), impeller, support legs, agitator mounting flange including bolts nuts and gasket etc.		
11.04.00	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.		
11.05.00	The material for the shaft (which is continuously in contact with slurry) and agitator blades of the Absorber Agitators shall be made with Alloy 926 or better material. For Agitators in other tanks, agitator blades shall be made with Alloy 926 or better material & shaft can be rubber lined. This does not release the Contractor of the		
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI BID DOC. NO.:CS-0011-109(6)-9	PART-B SUB-SECTION-I-M1 (FGD)	PAGE 31 OF 50

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	responsibility for selecting the correct materials.			
11.06.00	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. It shall be possible to remove the sealing devices of the Agitators of the absorber vessel without having to drain completely the absorber.			
11.07.00	To prevent mechanical blocking load start-up after standstill of pumps, piping and agitators for slurries shall be applied with C-hose connection.			
11.08.00	Lifting lugs and eyes and other special tackle shall be provided as necessary to permit easy handling of the agitators and their components.			
11.09.00	Static and dynamic (as far as applicable) balancing of all agitators shall be carried out after assembly.			
11.10.00	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. For side entry agitators the alternating bending moment resulting from impeller and shaft weight has to be considered additionally.			
11.11.00	All exposed moving parts shall be covered by guards.			
11.12.00	Side entry agitator shall be flange mounted.			
11.13.00	The shape of the impeller blades of side entry 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 coal & limestone specified in the specification. In order to avoid excessive wear impeller tip speeds must not exceed 12 m/s.			
11.14.00	Belt drives (if applied) shall be properly designed to provide a minimum lifetime of 2 years under design conditions			
12.00.00	SLURRY LINES AND VALVES			
12.01.00	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.			
12.02.00	All the pipes handling slurry shall be provided with replaceable rubber lining of proven quality. The Contractor can provide slurry pipes size up to 400NB made up of FRP material as per ASTM 2310 and testing as per ASTM B2583 (silicon carbide coating on slurry exposed surface) if it has previous experience of providing the same. Outer surface of the pipes should be fire retardant.			
12.03.00	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 operation as indicated in the relevant scheme.			
12.04.00	The valves shall be of proven type and the contractor shall submit a detailed valve			
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	TITLE:	SPECIFICATION No: PE-TS-491-167-A001	
	2X500MW NTPC SIPAT STPP, STAGE-II TECHNICAL SPECIFICATIONS FOR MISC. TANKS (SITE FABRICATED) AND AGITATORS	SECTION-I, SUB-SECTION-C2B	
		REV. 00	DATE: NOV 222
		SHEET: 1 OF 1	

GENERAL TECHNICAL REQUIREMENT



GENERAL TECHNICAL REQUIREMENTS

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1.00.00	INTRODUCTION This part covers technical requirements which will form an integral part of the Contract. The following provisions shall supplement all the detailed technical specifications and requirements brought out in Section-VI, the Technical Specification and the Technical Data Sheets.			
2.00.00	BRAND NAME Whenever a material or article is specified or described by the name of a particular brand, manufacturer or vendor, the specific item mentioned shall be understood to be indicative of the function and quality desired, and not restrictive; other manufacturer's products may be considered provided sufficient information is furnished to enable the Employer to determine that the products proposed are equivalent to those named.			
3.00.00	BASE OFFER & ALTERNATE PROPOSALS The Bidder's proposal shall be based upon the use of equipment and material complying fully with the requirements specified herein. It is recognised that the Contractor may have standardized on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered, provided the base offer is in line with technical specifications and such proposals meet the specified design standards and performance requirement and are acceptable to the Employer. Sufficient amount of information for justifying such proposals shall be furnished to Employer alongwith the bid to enable the Employer to determine the acceptability of these proposals.			
4.00.00	COMPLETENESS OF FACILITIES			
4.01.00	Bidders may note that this is a contract inclusive of the scope as indicated elsewhere in the specification. Each of the plant shall be engineered and designed in accordance with the specification requirement. All engineering and associated services are required to ensure a completely engineered plant shall be provided.			
4.02.00	All equipments furnished by the Contractor shall be complete in every respect, with all mountings, fittings, fixtures and standard accessories normally provided with such equipment and/or those needed for erection, completion and safe operation of the equipment and for the safety of the operating personnel, as required by applicable codes, though they may not have been specifically detailed in the respective specifications, unless included in the list of exclusions. All same standard components/ parts of same equipment provided, shall be interchangeable with one another.			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
4.03.00	For the C&I systems, the Contractor shall be required to provide regular information about future upgrades and migration paths to the Employer.		
5.00.00	RULES, REGULATIONS, CODES & STANDARDS		
5.01.00	<p>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, NTPC rules/codes of practices as well as of the locality where they will be installed, including the following:</p> <ul style="list-style-type: none"> a) Indian Electricity Act b) Indian Electricity Rules c) Indian Explosives Act d) Indian Factories Act and State Factories Act 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, 		
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
5.02.00	<p>(p.) Gas Cylinder Rules, 1981</p> <p>(q.) Static and Mobile Pressure Vessels (Unified) Rules, 1981</p> <p>(r.) Workmen's Compensation Act, 1923</p> <p>(s.) Workmen's Compensation Rules, 1924</p> <p>(t.) NTPC Safety Rules for Construction and Erection</p> <p>(u.) NTPC Safety Policy</p> <p>(v.) Any other statutory codes / standards / regulations, as may be applicable.</p> <p>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:</p> <p>a) Bureau of Indian standards (BIS)</p> <p>b) Japanese Industrial Standards (JIS)</p> <p>c) American National Standards Institute (ANSI)</p> <p>d) American Society of Testing and Materials (ASTM)</p> <p>e) American Society of Mechanical Engineers (ASME)</p> <p>f) American Petroleum Institute (API)</p> <p>g) Standards of the Hydraulic Institute, U.S.A.</p> <p>h) International Organisation for Standardisation (ISO)</p> <p>i) Tubular Exchanger Manufacturer's Association (TEMA)</p> <p>j) American Welding Society (AWS)</p> <p>k) National Electrical Manufacturers Association (NEMA)</p> <p>l) National Fire Protection Association (NFPA)</p> <p>m) International Electro-Technical Commission (IEC)/European Norm (EN)</p> <p>n) Expansion Joint Manufacturers Association (EJMA)</p> <p>o) Heat Exchange Institute (HEI)</p>			
<p align="center">LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 3 OF 75</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
5.03.00	p) IEEE standard q) JEC standard	Other International/ National standards such as DIN, JIS, VDI, EN, BS, GOST etc. shall also be accepted for only material codes and manufacturing standards, subject to the Employer'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.		
5.04.00	Not used.			
5.05.00	In the event of any conflict between the codes and standards referred to in the above clauses and the requirement of this specification, the requirement of Technical Specification shall govern.			
5.06.00	Two (2) English language copies of all national and international codes and/or standards used in the design of the plant, equipment, civil, structural and architectural works shall be provided by the Contractor to the Employer within two calendar months from the date of the Notification of Award.			
5.07.00	In case of any change in codes, standards & regulations between the date of bid opening and the date when vendors proceed with fabrication, the Employer 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 the Employer such changes and advise Employer of the resulting effect.			
5.08.00	A detailed list of standards apart from those mentioned in the respective detailed specifications in other parts of Section-VI to which all equipment/systems/civil works should conform as indicated in this Part C and elsewhere in the specification.			
6.00.00	EQUIPMENT FUNCTIONAL GUARANTEE			
6.01.00	The functional guarantees of the equipment under the scope of the Contract is given in Section-VI Part - A of Technical Specifications. These guarantees shall supplement the general functional guarantee provisions covered under Defect liabilities Section-IV, General Conditions of Contract.			
6.02.00	Liquidated damages for shortfall in meeting functional guarantee(s) during the performance and guarantee tests shall be assessed and recovered from the Contractor as specified elsewhere in this specification.			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
7.00.00	DESIGN OF FACILITIES/ MAINTENANCE & AVAILABILITY CONSIDERATIONS			
7.01.00	<p>DESIGN OF FACILITIES</p> <p>All the design procedures, systems and components proposed shall have already been adequately developed and shall have demonstrated good reliability under similar conditions elsewhere.</p> <p>The Contractor shall be responsible for the selection and design of appropriate equipments to provide the best co-ordinated performance of the entire system. The basic requirements are detailed out in various clauses of the Technical Specifications. The design of various components, assemblies and subassemblies shall be done so that it facilitates easy field assembly and dismantling. All the rotating components shall be so selected that the natural frequency of the complete unit is not critical or close to the operating range of the unit.</p>			
7.02.00	<p>MAINTENANCE AND AVILABILITY CONSIDERATIONS</p> <p>Equipment/works offered shall be designed for high availability, low maintenance and ease of maintenance. The Bidder shall specifically state the design features incorporated to achieve high degree of reliability/ availability and ease of maintenance. The Bidder shall also furnish details of availability records in the reference plants stated in his experience list.</p> <p>Bidder shall state in his offer the various maintenance intervals, spare parts and man-hour requirement during such operation. The intervals for each type of maintenance namely inspection of the furnace, inspection of the entire hot gas path and the minor and major overhauls shall be specified in terms of fired hours , clearly defining the spare parts and man-hour requirement for each stage.</p> <p>Lifting devices i.e. hoists and chain pulley jacks ,etc. shall be provided by the contractor for handling of any equipment or any of its part having weight in excess of 500 Kgs during erection and maintenance activities.</p> <p>Lifting devices like lifting tackles, slings, etc. to be connected to hook of the hoist/ crane shall be provided by the contractor for lifting the equipment and accessories covered under the specification.</p>			
8.00.00	DOCUMENTS, DATA AND DRAWINGS TO BE FURNISHED BY CONTRACTOR			
8.01.00	Bidders may note that this is a contract inclusive of the scope as indicated elsewhere in the specification. Each of the plant and equipment shall be fully integrated, engineered and designed to perform in accordance with the technical specification. All engineering and technical services required to ensure a completely			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
8.02.00	<p>engineered plant shall be provided in respect of mechanical, electrical, control & instrumentation, civil & structural works as per the scope.</p> <p>Each main and auxiliary equipment/item of the plant including instruments shall be assigned a unique tag number. The assignment of tag numbers shall be in accordance with KKS system. In all drawings/documents/data sheet etc. KKS tag number of the equipment/item/instrument etc. shall be indicated.</p> <p>The Contractor shall furnish engineering data /drawings in accordance with the schedule of information as specified in Technical Data Sheets and Technical Specification.</p> <p>A comprehensive engg and quality coordination procedure shall be finalized with the successful bidder covering salient features as described in this section of specifications.</p>			
8.03.00	<p>The number of copies/prints/CD-ROMs/manuals to be furnished for various types of document is given in Annexure VI to this Part C, Section VI of the Technical Specification.</p>			
8.03.01	<p>The documentation that shall be provided by the Contractor is indicated in the various sections of specification. This documentation shall include but not be limited to the following:</p> <p>A) BASIC ENGINEERING DOCUMENTATION</p> <p>Prior to commencement of the detailed engineering work, the Contractor shall furnish a Plant Definition Manual within 12 weeks from the date of the Notification of Award. This manual shall contain the following as a minimum:</p> <ul style="list-style-type: none"> i) System description of all the mechanical, electrical, control & instrumentation & civil systems. ii) Technology scan for each system / sub-system & equipment. iii) Selection of appropriate technology / schemes for various systems/ subsystems including techno-economic studies between various options. iv) Optimisation studies including thermal cycle optimisation. v) Sizing criteria of all the systems, sub-systems/ equipments/ structures/ equipment foundations alongwith all calculations justifying and identifying the sizing and the design margins. vi) Schemes and Process & Instrumentation diagrams for the various systems/ sub-system with functional write-ups. 			
<p align="center">LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 6 OF 75</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS 		
	<p>vii) Operation Philosophy and the control philosophy of the equipments/system covered under the scope.</p> <p>ix) General Layout plan of the FGD System incorporating all facilities in Bidder's as well as those in the Employer's scope. This drawing shall also be furnished in the form of CD-ROMs to the Employer for engineering of areas not included in bidder's scope.</p> <p>x) Basic layouts and cross sections of the main plant building (various floor elevations), boiler, fuel oil area and other areas included in the scope of the bidder.</p> <p>xi) Documentation in respect of Quality Assurance System as listed out elsewhere in this specification.</p> <p>The successful bidder shall furnish within three (3) weeks from the date of Notification of Award, a list of contents of the Plant Definition Manual (PDMs) including techno-economic studies, which shall then be mutually discussed & finalised with the Employer.</p> <p>B) DETAILED ENGINEERING DOCUMENTS</p> <p>i) General layout plan of the FGD System.</p> <p>ii) Layouts, general arrangements, elevations and cross-sections drawings for all the equipment and facilities of the plant.</p> <p>iii) Flow diagram, process and instrumentation diagrams along with write up and system description.</p> <p>iv) Performance curves for Absorber</p> <p>v) Piping isometric, composite layout and fabrication drawings.</p> <p>vi) Piping engineering diagrams, pipe and fittings schedules, valve schedules, hanger and support schedules, insulation schedules.</p> <p>vii) Technical data sheets for all bought out and manufactured items. Contractor shall use the Employer's specifications as a base for placement of orders on their sub vendors.</p> <p>viii) Detailed design calculations for components, system, piping etc., wherever applicable including sizing calculations for all auxiliaries like mills, fans etc. as per criteria specified elsewhere in specification.</p> <p>ix) Absorber sizing calculations. Absorber performance data.</p>		
<p>LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 7 OF 75</p>


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	<div style="text-align: right; border: 1px solid black; padding: 2px; width: fit-content; margin-bottom: 10px;"> एनटीपीसी NTPC </div> <ul style="list-style-type: none"> x) Mass Balance Diagram xi) Characteristic Curves/ Performance Correction Curves. xii) Comprehensive list of all terminal points which interface with Employer's facilities, giving details of location, terminal pressure, temperature, fluid handled & end connection details, forces, moments etc. xiii) Power supply single line diagram, block logics, control schematics, electrical schematics, etc. xiv) Protection system diagrams and relay settings. xv) Cables schedules and interconnection diagrams. xvii) Cable routing plan. xviii) Instrument schedule, measuring point list, I/O list, Interconnection & wiring diagram, functional write-ups, and installation drawings for field mounted instruments, logic diagrams, control schematics, wiring and tubing diagrams of panels and enclosures etc. Drawings for open loop and close loop controls (both hardware and software). Motor list and valve schedule including type of actuator etc. xix) Alarm and annunciation/ Sequence of Event (SOE) list and alarms & trip set points. xx) Sequence and protection interlock schemes. xxi) Type test reports, insulation co-ordination study report xxii) Control system configuration diagrams and card circuit diagrams and maintenance details. xxiii) Detailed Control system manuals. xxiv) Detailed flow chart for digital control system. xv) Mimic diagram layout, Assignment for other application engg. drawings and documents. xxvi) Civil and Structural works drawings and documents for all structures, facilities, architectural works, foundations underground and overground works and super-structural works as included in the 		
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8.03.02	<p>scope of the bidder civil calculation sheets including structural analysis and design alongwith output results.</p> <p>xxvii) Underground facilities, levelling, sanitary, land scaping drawings.</p> <p>xxviii) Geotechnical investigation and site survey reports (if and as applicable).</p> <p>xxix) Model study reports wherever applicable.</p> <p>xxx) Functional & guarantee test procedures and test reports.</p> <p>xxxi) Documentation in respect of Quality Assurance System, and Documentation in respect of Commissioning, as listed out elsewhere in this specification.</p> <p>xxxii) Maintenance schedule for Absorber & auxiliaries clearly indicating interval, duration if shutdown required, manhours required and tools & tackles required for maintenance.</p> <p>The Contractor's while submitting the above documents/ drawings for approval/ reference as the case may be, shall mark on each copy of submission the reference letter alongwith the date vide which the submissions are made.</p> <p>INSTRUCTION MANUALS</p> <p>The Contractor shall make first submission of instruction manual for all the equipments covered under the Contract as per agreed engineering information schedule. The Instruction manuals shall contain full details required for erection, commissioning, operation and maintenance of each equipment. The manual shall be specifically compiled for this project. After finalisation and approval of the Employer the Instruction Manuals shall be submitted as indicated in Annexure-IV. The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals have been supplied to the Employer. The Instruction Manuals shall comprise of the following.</p> <p>A) ERECTION MANUALS</p> <p>The erection manuals shall be submitted atleast three (3) months prior to the commencement of erection activities of particular equipment/system. The erection manual should contain the following as a minimum.</p> <p>a) Erection strategy.</p> <p>b) Sequence of erection.</p>		
<p align="center">LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 9 OF 75</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>c) Erection instructions.</p> <p>d) Critical checks and permissible deviation/tolerances.</p> <p>e) List of tool, tackles, heavy equipments like cranes, dozers, etc.</p> <p>f) Bill of Materials</p> <p>g) Procedure for erection and General Safety procedures to followed during erection/installation.</p> <p>h) Procedure for initial checking after erection.</p> <p>i) Procedure for testing and acceptance norms.</p> <p>j) Procedure / Check list for pre-commissioning activities.</p> <p>k) Procedure / Check list for commissioning of the system.</p> <p>l) Safety precautions to be followed in electrical supply distribution during erection.</p> <p>B) OPERATION & MAINTENANCE MANUALS</p> <p>a) The manual shall be a two rim PVC bound stiff sided binder able to withstand constant usage or where a thicker type is required it shall have locking steel pins, the size of the manual shall not be larger than international size A3. The cover shall be printed with the Project Name, Services covered and Volume / Book number Each section of the manual shall be divided by a stiff divider of the same size as the holder. The dividers shall clearly state the section number and title. All written instructions within the manual not provided by the manufacturers shall be typewritten with a margin on the left hand side.</p> <p>b) The arrangement and contents of O & M manuals shall be as follows:</p> <p>1) <u>Chapter 1 - Plant Description</u>: To contain the following sections specific to the equipment/system supplied</p> <p>(a) Description of operating principle of equipment / system with schematic drawing / layouts.</p>			
<p>LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 10 OF 75</p>	


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	<p>(b) Functional description of associated accessories / controls. Control interlock protection write up.</p> <p>(c) Integrated operation of the equipment alongwith the intended system. (This is to be given by the supplier of the Main equipment by taking into account the operating instruction given by the associated suppliers).</p> <p>(d) Exploded view of the main equipment, associated accessories and auxiliaries with description. Schematic drawing of the equipment alongwith its accessories and auxiliaries.</p> <p>(e) Design data against which the plant performance will be compared.</p> <p>(f) Master list of equipments, Technical specification of the equipment/ system and approved data sheets.</p> <p>(g) Identification system adopted for the various components, (it will be of a simple process linked tagging system).</p> <p>(h) Master list of drawings (as built drawing - Drawings to be enclosed in a separate volume).</p> <p>2) <u>Chapter 2.0 - Plant Operation</u>: To contain the following sections specific to the equipment supplied</p> <p>(a) Protection logics provided for the equipment alongwith brief philosophy behind the logic, Drawings etc.</p> <p>(b) Limiting values of all protection settings.</p> <p>(c) Various settings of annunciation/interlocks provided.</p> <p>(d) Startup and shut down procedure for equipment alongwith the associated systems in step mode.</p> <p>(e) Do's and Don'ts related to operation of the equipment.</p> <p>(f) Safety precautions to be take during normal operation. Emergency instruction on total power failure condition/lubrication failure/any other conditions.</p> <p>(g) Parameters to be monitored with normal value and limiting values.</p> <p>(h) Equipment isolating procedures.</p>			
<p align="center">LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 11 OF 75</p>	


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	<p>(i) Trouble shooting with causes and remedial measures.</p> <p>(j) Routine testing procedure to ascertain healthiness of the safety devices alongwith schedule of testing.</p> <p>(k) Routine Operational Checks, Recommended Logs and Records</p> <p>(l) Change over schedule if more than one auxiliary for the same purpose is given.</p> <p>(m) Preservation procedure on long shut down.</p> <p>(n) System/plant commissioning procedure.</p> <p>3) <u>Chapter 3.0 - Plant Maintenance</u>- To contain the following sections specific to the equipment supplied.</p> <p>(a) Exploded view of each of the equipments. Drawings alongwith bill of materials including name, code no. & population.</p> <p>(b) Exploded view of the spare parts and critical components with dimensional drawings (In case of Electronic cards, the circuit diagram to be given) and spare parts catalogue for each equipment.</p> <p>(c) List of Special T/ P required for Overhauling /Trouble shooting including special testing equipment required for calibration etc.</p> <p>(d) Stepwise dismantling and assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained etc. Clearance to be maintained etc.</p> <p>(e) Preventive Maintenance schedules linked with running hours/calendar period alongwith checks to be carried out.</p> <p>(f) Overhauling schedules linked with running hours/calendar period alongwith checks to be done.</p> <p>(g) Long term maintenance schedules</p> <p>(h) Consumables list alongwith the estimated quantity required during normal running and during maintenance like Preventive Maintenance and Overhauling.</p> <p>(i) List of lubricants with their Indian equivalent, Lubrication Schedule including charts showing lubrication checking, testing and replacement procedure to be carried daily, weekly, monthly & at</p>			
<p align="center">LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 12 OF 75</p>	


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8.03.03	<p>longer intervals to ensure trouble free operation and quantity required for complete replacement.</p> <p>(j) Tolerance for fitment of various components.</p> <p>(k) Details of sub vendors with their part no. in case of bought out items.</p> <p>(l) List of spare parts with their Part No, total population, life expediency & their interchangeability with already supplied spares to NTPC.</p> <p>(m) List of mandatory and recommended spare list along with manufacturing drawings, material specification & quality plan for fast moving consumable spares.</p> <p>(n) Lead time required for ordering of spares from the equipment supplier, instructions for storage and preservation of spares.</p> <p>(o) General information on the equipment such as modification carried out in the equipment from its inception, equipment population in the country / foreign country and list of utilities where similar equipments have been supplied.</p> <p>After finalization and approval of the Employer, the O & M Manuals shall be submitted as indicated in Annexure-VI. The Contract shall not be considered to be completed for purposes of taking over until the final Instructions manuals (both erection and O & M manuals have been supplied to the Employer.</p> <p>If after the commissioning and initial operation of the plant, the instruction manuals (Erection and /or O &M manuals) require modifications/additions/changes, the same shall be incorporated and the updated final instruction manuals shall be submitted by the Contractor to the Employer for records and number of copies shall be as mentioned in Annexure-VI.</p>			
8.03.03	PLANT HANDBOOK AND PROJECT COMPLETION REPORT			
8.03.03.01	<p>PLANT HANDBOOK</p> <p>The Contractor shall submit to the Employer a preliminary plant hand book preferably in A-4 size sheets which shall contain the design and performance data of various plants, equipments and systems covering the complete project including</p> <p>i) Design and performance data.</p> <p>ii) Process & Instrumentation diagrams.</p> <p>iii) Single line diagrams.</p>			
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	iv) Sequence & Protection Interlock Schemes. v) Alarm and trip values. vi) Performance Curves. vii) General layout plan and layout of main plant building and auxiliary buildings viii) Important Do's & Don't's The plant handbook shall be submitted within twelve (12) months from the date of award of contract. After the incorporation of Employer's comments, the final plant handbook complete in all respects shall be submitted three (3) months before start-up and commissioning activities.			
8.03.03.02	PROJECT COMPLETION REPORT The Contractor shall submit a Project Completion Report at the time of handing over the plant.			
8.03.04	DRAWINGS a) i) All the FGD plant layouts shall be made in computerised 3D modelling system. The Employer reserves the right to review the 3D model at different stages during the progress of engineering. The layout drawings submitted for Employer's review shall be fully dimensioned and extracted from 3D model after interference check. ii) All documents submitted by the Contractor for Employer's review shall be in electronic form (soft copies) along with the desired number of hard copies as per Annexure-VI of Part-C. The soft copies shall be uploaded by the vendors in C-folders, a Web-based system of NTPC ERP, for which a username and password will be allotted to the new vendor by NTPC. Similarly, the vendor can download the drawings/documents, approved/ commented by NTPC, through above site. The soft copies of identified drawings/documents shall be in pdf format, whereas the attachments/reply to the submitted document(s) can be in .doc, .xls, .pdf, .dwg or .std formats. iii) Final copies of the approved drawings along with requisite number of hard copies shall be submitted as per Annexure-VI of Part-C. iv) Contractor shall prepare the model of all the facilities located in FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE (including all			
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	<p>facilities), and any other facility in an integrated & intelligent 3D software solution using rule-based, data centric 3D Design software with equipment drawings, data sheets, intelligent P&ID correlated with intelligent 3D Model, BOQ, schematics and logic diagrams etc. attached to the respective equipment / systems in the aforesaid 3D model. Contractor shall make a presentation on 3D model every 3 months from LOA to enable NTPC to review the progress of engineering. After the completion of engineering the corresponding complete 3D review model shall be handed over to the employer for its reference.</p> <p>Contractor shall provide 3D model (which shall include visual interference check, walk-through animation, video simulation for major equipment placement and removal, visual effect, photo realism etc), which is extracted from intelligent 3D model, for employer's review as & when desired by employer. However, all piping layouts, equipment layouts, floor plans, ducting layout (Air/flue gas, A/C, Ventilation etc.), General Arrangement drawings of major buildings, structural arrangement drawings and RCC layout drawings shall necessarily be extracted from the aforesaid 3D model and submitted for employer's review along with the 3D review model to enable NTPC to review and approve these drawings.</p> <p>b) All documents/text information shall be in latest version of MS Office / MS Excel / PDF FORMAT as applicable.</p> <p>c) All drawings submitted by the Contractor including those submitted at the time of bid shall be in sufficient detail indicating the type, size, arrangement, weight of each component for packing and shipment, the external connection, fixing arrangement required, the dimensions required for installation and interconnections with other equipments and materials, clearance and spaces required between various portions of equipment and any other information specifically requested in the drawing schedules.</p> <p>d) Each drawing submitted by the Contractor (including those of subvendors) shall bear a title block at the right hand bottom corner with clear mention of the name of the Employer, the system designation, the specifications title, the specification number, the name of the Project, drawing number and revisions. If standard catalogue pages are submitted the applicable items shall be indicated therein. All titles, notings, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.</p> <p>e) The drawings submitted by the Contractor (or their subvendors) shall bear Employer's drawing number in addition to contractor's (their sub-vendor's) own drawing number. Employer's drawing numbering system shall be made available to the successful bidder so as to enable him to assign Employer's drawing numbers to the drawings to be submitted by him during the course of execution of the Contract.</p>			
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	<p>The Contractor shall also furnish a "Master Drawing List" which shall be a comprehensive list of all drawings/ documents/ calculations envisaged to be furnished by him during the detailed engineering to the Employer. Such list should clearly indicate the purpose of submission of these drawings i.e. "FOR APPROVAL" or "FOR INFORMATION ONLY".</p> <p>Similarly, all the drawings/ documents submitted by the Contractor during detailed engineering stage shall be marked "FOR APPROVAL" or "FOR INFORMATION" prior to submission. Further, space shall be identified on each drawing for Approval stamp and electronic signature.</p> <p>f) The furnishing of detailed engineering data and drawings by the Contractor shall be in accordance with the time schedule for the project. The review of these documents/ data/ drawings by the Employer will cover only general conformance of the data/ drawings/ documents to the specifications and contract, interfaces with the equipments provided by others and external connections & dimensions which might affect plant layout. The review by the Employer should not be construed to be a thorough review of all dimensions, quantities and details of the equipments, materials, any devices or items indicated or the accuracy of the information submitted. The review and/ or approval by the Employer/ Project Manager shall not relieve the Contractor of any of his responsibilities and liabilities under this contract.</p> <p>g) After the approval of the drawings, further work by the Contractor shall be in strict accordance with these approved drawings and no deviation shall be permitted without the written approval of the Employer.</p> <p>h) All manufacturing, fabrication and execution of work in connection with the equipment / system, prior to the approval of the drawings, shall be at the Contractor's risk. The Contractor is expected not to make any changes in the design of the equipment /system, once they are approved by the Employer. However, if some changes are necessitated in the design of the equipment/system at a later date, the Contractor may do so, but such changes shall promptly be brought to the notice of the Employer indicating the reasons for the change and get the revised drawing approved again in strict conformance to the provisions of the Technical Specification.</p> <p>i) Drawings shall include all installations and detailed piping layout drawings. Layout drawings for all piping of 65 mm and larger diameter shall be submitted for review/ approval of Employer prior to erection. Small diameter pipes shall however be routed as per site conditions in consultation with site authority/ representative of Employer based on requirements of such piping indicated in approved/ finalised Flow Scheme/ Process & Instrumentation Diagrams and/or the requirements cropping up for draining & venting of larger diameter piping or otherwise after their erection as per actual physical condition for the entire scope of work of this package.</p>			
<p align="center">LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 16 OF 75</p>	


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	<p>Assessing & anticipating the requirement and supply of all piping and equipment shall be done by the contractor well in advance so as not to hinder the progress of piping & equipment erection, subsequent system charging and its effective draining & venting arrangement as per site suitability.</p> <p>j) As Built Drawings</p> <p>After final acceptance of individual equipment / system by the Employer, the Contractor will update all original drawings and documents for the equipment / system to “as built” conditions and submit no. of copies as per Annexure VI.</p> <p>k) Drawings must be checked by the Contractor in terms of its completeness, data adequacy and relevance with respect to Engineering schedule prior to submission to the Employer. In case drawings are found to be submitted without proper checking by the Contractor, the same shall not be reviewed and returned to the Contractor for re-submission. The contractor shall make a visit to site to see the existing facilities and understand the layout completely and collect all necessary data/ drawings at site which are needed as an input to the engineering. The contractor shall do the complete engineering including interfacing and integration of all his equipment, systems & facilities within his scope of work as well as interface engineering & integration of systems, facilities, equipment & works under Employer's scope and submit all necessary drawings/ documents for the same.</p> <p>l) The Contractor shall submit adequate prints of drawing / data / document for Employer's review and approval. The Employer shall review the drawings and return soft copy to the Contractor authorizing either to proceed with manufacture or fabrication, or marked to show changes desired. When changes are required, drawings shall be re-submitted promptly, with revisions clearly marked, for final review. Any delays arising out of the failure of the Contractor to submit/rectify and resubmit in time shall not be accepted as a reason for delay in the contract schedule.</p> <p>m) All engineering data submitted by the Contractor after final process including review and approval by the Project Manager/ Employer shall form part of the contract documents and the entire works covered under these specification shall be performed in strict conformity with technical specifications unless otherwise expressly requested by the Project Manager in writing.</p> <p>n) The Contractor shall submit drawings in line with the suggestive MDL covered in Part-B, Section-VI of Technical Specification and which shall be duly integrated with approved PERT network.</p>			
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8.04.00	<p>ENGINEERING INFORMATION SUBMISSION SCHEDULE</p> <p>Prior to the award of Contract, a Detailed Engineering Information Submission Scheduler/Master Drawing List duly integrated with approved PERT network shall be tied up with the Employer. For this, the bidder shall furnish a detailed list of engineering information alongwith the proposed submission schedule. This list would be a comprehensive one including all engineering data / drawings / information for all bought out items and manufactured items. The information shall be categorized into the following parts.</p> <p>i) Information that shall be submitted for the approval to the Employer before proceeding further, and</p> <p>ii) Information that would be submitted for Employer's information only.</p> <p>The Master Drawing List (MDL) shall be updated periodically and submitted to the employer, highlighting the changes made in MDL.</p> <p>The schedule should allow adequate time for proper review and incorporation of changes/ modifications, if any, to meet the contract without affecting the equipment delivery schedule and overall project schedule. The early submission of drawings and data is as important as the manufacture and delivery of equipment and hardware and this shall be duly considered while determining the overall performance and progress.</p>			
8.05.00	<p>ENGINEERING PROGRESS AND EXCEPTION REPORT</p>			
8.05.01	<p>The Contractor shall submit every month an Engineering progress and Exception Report giving the status of each engineering information including</p> <p>a) A list of drawings/engineering information which remains unapproved for more than four (4) weeks after the date of first submission</p> <p>b) Drawings which were not submitted as per agreed schedule.</p>			
8.05.02	<p>The draft format for this report shall be furnished to the Employer within four (4) weeks of the award of the contract, which shall then be discussed and finalised with the Employer.</p>			
8.06.00	<p>Engineering Co-ordination Procedure</p>			
8.06.01	<p>The following principal coordinators will be identified by respective organizations at time of award of contract:</p> <p>NTPC Engineering Coordinator (NTPC EC):</p>			
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<p>8.06.02</p> <p>8.06.03</p>	<p>Name :</p> <p>Designation :</p> <p>Address :</p> <p>a) Postal :</p> <p>b) Telegraphic / e-Mail :</p> <p>c) FAX : TELEPHONE :</p> <p>Contractor's/ Vendor's Engineering Coordinator (VENDOR EC):</p> <p>Name :</p> <p>Designation :</p> <p>Address :</p> <p>a) Postal :</p> <p>b) Telegraphic / e-Mail :</p> <p>c) FAX : TELEPHONE :</p> <p>All engineering correspondence shall be in the name of above coordinators on behalf of the respective organizations.</p> <p>Contractor's/Vendor's Drawing Submission and Approval Procedure:</p> <p>a) All data/information furnished by Vendor in the form of drawings/ documents/catalogues or in any other form for NTPC's information/ interface and or review and approval are referred by the general term "drawings".</p> <p>b) The 'Master drawings list' indicating titles, Drawing Number, Date of submission and approval etc. shall be finalised mutually between Contractor and Employer before the award of contract. This list shall be updated if required at suitable interval during detailed engineering.</p> <p>c) All drawings (including those of subvendor's) shall bear at the right hand bottom corner the 'title plate' with all relevant information duly filled in. The Contractor shall furnish this format to his subvendor along with his purchase order for subvendor's compliance.</p>			
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	<p>d) Employer and contractor shall follow their own numbering systems for the drawings. However, Employer shall intimate the contractor, NTPC drawing number on receipt of the first submission of each drawing. Vendor, thereafter, shall indicate NTPC's drawing number in subsequent Submission, in the space provided for this purpose in title plate, in addition to his own drawing number.</p> <p>e) The contractor shall make a visit to site to see the existing facilities and understand the layout completely and collect all necessary data / drawings at site which are needed as an input to the engineering. The contractor shall do the complete engineering including interfacing and integration of all his equipment, systems & facilities within his scope of work as well as interface engineering & integration of systems, facilities, equipment & works under Employer's scope and submit all necessary drawings/ documents for the same.</p> <p>f) Drawings must be checked by the Contractor in terms of its completeness, data adequacy and relevance with respect to engineering schedule prior to submission to the Employer. In case drawings are found to be submitted without proper endorsement for checking by the Contractor, the same shall not be reviewed and returned to the Contractor for re-submission.</p> <p>g) The Contractor shall submit adequate prints of drawing / data / document for Employer's review and approval. The drawings submitted by the Contractor/vendor shall be reviewed by NTPC and their comments shall be forwarded within four (4) weeks of receipt of drawings. Upon review of each drawing, depending on the correctness and completeness of the drawing, the same will be categorized and approval accorded in one of the following categories :</p> <p>CATEGORY- I: Approved</p> <p>CATEGORY- II Approved, subject to incorporation of comments/ modification as noted. Resubmit revised drawing incorporating the comments.</p> <p>CATEGORY –III Not approved. Resubmit revised drawings for approval after incorporating comments/ modification as noted.</p> <p>CATEGORY -IV For information and records.</p> <p>h) Contractor shall resubmit the drawings approved under Category II, III & IV within three (3) weeks of receipt of comments on the drawings, incorporating all comments. Every revision of the drawing shall bear a revision index wherein such revisions shall be highlighted in the form of description or marked up in the drawing identifying the same with relevant revision Number</p>			
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	<p>enclosed in a triangle (eg. 1, 2, 3 etc). Contractor shall not make any changes in the portions of the drawing other than those commented. If changes are required to be made in the portions already approved, the Contractor shall resubmit the drawing identifying the changes for Employer's review and approval. Drawings resubmitted shall show clearly the portions where the same are revised marking the relevant revision numbers and Employer shall review only such revised portion of documents.</p> <p>i) In case, the Contractor/ Vendor does not agree with any specific comment, he shall furnish the explanation for the same to NTPC for consideration. In all such cases the Contractor shall necessarily enclose explanations along with the revised drawing (taking care of balance comments) to avoid any delay and/or duplication in review work.</p> <p>j) It is responsibility of the Contractor/ Vendor to get all the drawings approved in the Category I & IV (as the case may be) and complete engineering activities within the agreed schedule. Any delay arising out of submission and modification of drawings shall not alter the contract completion schedule.</p> <p>k) If Contractor/ Vendor fails to resubmit the drawings as per the schedule, construction work at site will not be held up and work will be carried out on the basis of comments furnished on previous issues of the drawing.</p> <p>l) These comments will be taken care by the contractor while submitting the revised drawing.</p> <p>The contractor shall use a single transmittal for drawings. Submission. This shall include transmittal numbers and date, number of copies being sent, names of the agencies to whom copies being sent, drawing number and titles, remarks or special notes if any etc.</p>			
9.00.00	TECHNICAL CO-ORDINATION MEETING			
9.01.00	<p>The Contractor shall be called upon to organise and attend monthly Design/ Technical Co-ordination Meetings (TCMs) with the Employer/Employer's representatives and other Contractors of the Employer during the period of contract. The Contractor shall attend such meetings at his own cost at NEW DELHI / NOIDA or at mutually agreed venue as and when required and fully co-operate with such persons and agencies involved during the discussions.</p>			
9.02.00	<p>The Contractor should note that Time is the essence of the contract. In order to expedite the early completion of engineering activities, the Contractor shall submit all drawings as per the agreed Engineering Information Submission Schedule. The drawings submitted by the Contractor will be reviewed by the Employer as far as practicable within three (3) weeks from the date of receipt of the drawing .The</p>			
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	<p>comments of the Employer shall then be discussed across the table during the above Technical Co-ordination Meeting (s) wherein best efforts shall be made by both sides to ensure the approval of the drawing.</p>			
9.02.01	<p>The Contractor shall ensure availability of the concerned experts / consultants/ personnel who are empowered to take necessary decisions during these meetings. The Contractor shall be equipped with necessary tools and facilities so that the drawings/documents can be resubmitted after incorporating necessary changes and approved during the meeting itself.</p>			
9.02.02	<p>Should any drawing remain unapproved for more than six (6) weeks after it's first submission ,this shall be brought out in the monthly Engineering Progress and Exception Report with reasons thereof.</p>			
9.03.0	<p>Any delays arising out of failure by the Contractor to incorporate Employer's comments and resubmit the same during the TCM shall be considered as a default and in no case shall entitle the Contractor to alter the Contract completion date.</p>			
10.00.00	<p>DESIGN IMPROVEMENTS</p> <p>The Employer or the Contractor may propose changes in the specification of the equipment or quality thereof and if the parties agree upon any such changes the specification shall be modified accordingly.</p> <p>If any such agreed upon change is such that it affects the price and schedule of completion, the parties shall agree in writing as to the extent of any changing the price and/or schedule of completion before the Contractor proceeds with the change. Following such agreement, the provision thereof, shall be deemed to have been amended accordingly.</p>			
11.00.00	<p>EQUIPMENT BASES</p> <p>A cast iron or welded steel base plate shall be provided for all rotating equipment which is to be installed on a concrete base, unless otherwise specifically agreed to by the Employer. Each base plate shall support the unit and its drive assembly, shall be of a neat design with pads for anchoring the units, shall have a raised lip all around, and shall have threaded drain connections.</p>			
12.00.00	<p>PROTECTIVE GUARDS</p> <p>Suitable guards shall be provided for protection of personnel on all exposed rotating and/or moving machine parts. All such guards shall be designed for easy installation and removal for maintenance purpose.</p>			
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13.00.00	LUBRICANTS, SERVO FLUIDS AND CHEMICALS			
13.01.00	<p>I. All the first fills of consumables and one years topping requirement of consumables such as greases, oil, lubricants, servo fluids / control fluids, gases and essential chemicals etc. which will be required to put the equipment covered under the scope of specifications, into successful commissioning / initial operation and to establish completion of facilities shall be supplied by the Contractor. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum.</p> <p>Bidder shall supply a quantity not less than 10 % of the full charge or one (1) year topping requirement mentioned above (whichever is higher) of each variety of lubricants, servo fluids, gases, chemicals etc (as detailed above) which is expected to be utilized during the first year of operation. The additional quantity shall be supplied in separate container.</p>			
13.02.00	<p>As far as possible lubricants marketed by the Indian Oil Corporation shall be used. The variety of lubricants shall be kept to a minimum possible.</p> <p>Detailed specifications for the lubricating oil, grease, gases, servo fluids, control fluids, chemicals etc. required for the complete plant covered herein shall be furnished. On completion of erection, a complete list of bearings/ equipment giving their location and identification marks shall be furnished to the Employer alongwith lubrication requirements.</p>			
14.00.00	LUBRICATION			
14.01.00	<p>Equipment shall be lubricated by systems designed for continuous operation. Lubricant level indicators shall be furnished and marked to indicate proper levels under both standstill and operating conditions.</p>			
15.00.00	MATERIAL OF CONSTRUCTION			
15.01.00	<p>All materials used for the construction of the equipment shall be new and shall be in accordance with the requirements of this specification. Materials utilised for various components shall be those which have established themselves for use in such applications.</p>			
16.00.00	RATING PLATES, NAME PLATES & LABELS			
16.01.00	<p>Each main and auxiliary item of plant including instruments shall have permanently attached to it in a conspicuous position, a rating plate of non-corrosive material upon which shall be engraved manufacturer's name, equipment, type or serial number together with details of the ratings, service conditions under which the item of plant in question has been designed to operate, and such diagram plates as may be required by the Employer.</p>			
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16.02.00	Each item of plant shall be provided with nameplate or label designating the service of the particular equipment. The inscriptions shall be approved by the Employer or as detailed in appropriate section of the technical specifications.			
16.03.00	Such nameplates or labels shall be of white nonhygroscopic material with engraved black lettering or alternately, in the case of indoor circuit breakers, starters, etc. of transparent plastic material with suitably coloured lettering engraved on the back. The name plates shall be suitably fixed on both front and rear side.			
16.04.00	Items of plant such as valves, which are subject to handling, shall be provided with an engraved chromium plated nameplate or label with engraving filled with enamel. The name plates for valves shall be marked in accordance with MSS standard SP-25 and ANSI B 16.34 as a minimum.			
16.05.00	Hanger/ support numbers shall be marked on all pipe supports, anchors, hangers, snubbers and restraint assemblies. Each constant and variable spring support shall also have stamped upon it the designed hot and cold load which it is intended to support. Suitable scale shall also be provided to indicate load on support or hanger.			
16.06.00	Valves, steam traps and strainers shall be identified by Employer's tag number of a metal tap permanently attached to non pressure parts such as the yoke by a stainless steel wire. The direction of flow shall also be marked on the body.			
16.07.00	Safety and relief valves shall be provided with the following: <ol style="list-style-type: none"> Manufacturer's identification. Nominal inlet and outlet sizes in mm. Set pressure in Kg/cm² (abs). Blowdown and accumulation as percentage of set pressure. Certified capacity in Kg of saturated steam per hour or in case of liquid certified capacity in litres of water per minute. 			
16.08.00	All such plates, instruction plates, etc. shall be bilingual with Hindi inscription first, followed by English. Alternatively, two separate plates one with Hindi and the other with English inscriptions may be provided.			
16.09.00	All segregated phases of conductors or bus ducts, indoor or outdoor, shall be provided with coloured phase plates to clearly identify the phase of the system.			
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17.00.00	<p>TOOLS AND TACKLES</p> <p>The Contractor shall supply with the equipment one complete set of all special tools and tackles and other instruments required and other instruments for the erection, assembly, disassembly and proper maintenance of the plant and equipment and systems (including software). These special tools will also include special material handling equipment, jigs and fixtures for maintenance and calibration / readjustment, checking and measurement aids etc. A list of such tools and tackles shall be submitted by the Bidder alongwith the offer.</p> <p>The price of each tool / tackle shall be deemed to have been included in the total bid price. These tools and tackles shall be separately packed and sent to site. The Contractor shall also ensure that these tools and tackles are not used by him during erection, commissioning and initial operation. For this period the Contractor should bring his own tools and tackles. In case these tools and tackles are used by the Contractor during erection, commissioning or initial operation the same shall be refurbished repaired/replaced as required to the satisfaction of the Employer before handing over to the Employer. All the tools and tackles shall be of reputed make acceptable to the Employer.</p>			
18.00.00	<p>WELDING</p>			
18.01.00	<p>If the manufacturer has special requirements relating to the welding procedures for welds at the terminals of the equipments to be per formed by others the requirements shall be submitted to the Employer in advance of commencement of erection work.</p>			
19.00.00	<p>COLOUR CODE FOR ALL EQUIPMENTS/ PIPINGS/ PIPE SERVICES</p>			
19.01.00	<p>All equipment/ piping/ pipe services are to be painted by the Contractor in accordance with Employer's standard colour coding scheme, which will be furnished to the Contractor during detailed engineering stage.</p>			
20.00.00	<p>PROTECTION AND PRESERVATIVE SHOP COATING</p>			
20.01.00	<p>PROTECTION</p> <p>All coated surfaces shall be protected against abrasion, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either metallic or a nonmetallic protection device. All ends of all valves and piping and conduit equipment connections shall be properly sealed with suitable devices to protect them from damage. The parts which are likely to get rusted, due to exposure to weather, should also be properly treated and protected in a suitable manner. All primers/paints/coatings shall take into account the hot humid, corrosive & alkaline, subsoil or over ground environment as the case may be. The requirements for</p>			
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	<p>painting specification shall be complied with as detailed out in Part-A & B of the Technical Specification.</p>			
20.02.00	<p>PRESERVATIVE SHOP COATING</p>			
	<p>All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. All surfaces which will not be easily accessible after the shop assembly, shall be treated beforehand and protected for the life of the equipment. All surfaces shall be thoroughly cleaned of all mill scales, oxides and other coatings and prepared in the shop. The surfaces that are to be finish-painted after installation or require corrosion protection until installation, shall be shop painted as per the requirements covered in the relevant part of the Technical Specification.</p>			
	<p>Transformers and other electrical equipments, if included shall be shop finished with one or more coats of primer and two coats of high grade resistance enamel. The finished colors shall be as per manufacturer's standards, to be selected and specified by the Employer at a later date.</p>			
20.03.00	<p>Shop primer for all steel surfaces which will be exposed to operating temperature below 95 degrees Celsius shall be selected by the Contractor after obtaining specific approval of the Employer regarding the quality of primer proposed to be applied. Special high temperature primer shall be used on surfaces exposed to temperature higher than 95 degrees Celsius and such primer shall also be subject to the approval of the Employer.</p>			
20.04.00	<p>All other steel surfaces which are not to be painted shall be coated with suitable dust preventive compound subject to the approval of the Employer.</p>			
20.05.00	<p>All piping shall be cleaned after shop assembly by shot blasting or other means approved by the Employer. Lube oil piping or carbon steel shall be pickled.</p>			
20.06.00	<p>Painting for Civil structures and equipment/system covered under this package shall be done as specified under technical requirements on civil works in relevant part of this specifications.</p>			
21.00.00	<p>QUALITY ASSURANCE PROGRAMME</p>			
21.01.00	<p>To ensure that the equipment and services under the scope of contract whether manufactured or performed within the Contractor's works or at his sub-contractor's premises or at the Employer's site or at any other place of work are in accordance with the specifications, the Contractor shall adopt suitable quality assurance programme to control such activities at all points, as necessary. Such programmes shall be outlined by the Contractor and shall be finally accepted by the Employer/authorised representative after discussions before the award of the contract. The QA programme shall be generally in line with ISO-9001/IS-14001. A</p>			
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	<p>quality assurance programme of the contractor shall generally cover the following:</p> <p>a) His organisation structure for the management and implementation of the proposed quality assurance programme</p> <p>b) Quality System Manual</p> <p>c) Design Control System</p> <p>d) Documentation Control System</p> <p>e) Qualification data for Bidder's key Personnel.</p> <p>f) The procedure for purchase of materials, parts, components and selection of sub-contractor's services including vendor analysis, source inspection, incoming raw-material inspection, verification of materials purchased etc.</p> <p>g) System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.</p> <p>h) Control of non-conforming items and system for corrective actions.</p> <p>i) Inspection and test procedure both for manufacture and field activities.</p> <p>j) Control of calibration and testing of measuring testing equipments.</p> <p>k) System for Quality Audits.</p> <p>l) System for indication and appraisal of inspection status.</p> <p>m) System for authorising release of manufactured product to the Employer.</p> <p>n) System for handling storage and delivery.</p> <p>o) System for maintenance of records, and</p> <p>p) Furnishing of quality plans for manufacturing and field activities detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment/component as per formats enclosed as Annexure-I and Annexure-II respectively.</p>			
22.00.00	GENERAL REQUIREMENTS - QUALITY ASSURANCE			
22.01.00	All materials, components and equipment covered under this specification shall be procured, manufactured, erected, commissioned and tested at all the stages, as per a comprehensive Quality Assurance Programme. An indicative programme of			
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	<p>inspection/tests to be carried out by the contractor for some of the major items is given in the respective technical specification. This is, however, not intended to form a comprehensive programme as it is the contractor's responsibility to draw up and implement such programme duly approved by the Employer. The detailed Quality Plans for manufacturing and field activities shall be drawn up by the Bidder and will be submitted to Employer for approval. Schedule of finalisation of such quality plans will be finalised before award on enclosed format No. QS-01-QAI-P-1/F3-R0. Monthly progress reports shall be furnished.</p>			
22.02.00	<p>Manufacturing Quality Plan will detail out for all the components and equipment, various tests/inspection, to be carried out as per the requirements of this specification and standards mentioned therein and quality practices and procedures followed by Contractor's/ Sub-contractor's/ sub-supplier's Quality Control Organisation, the relevant reference documents and standards, acceptance norms, inspection documents raised etc., during all stages of materials procurement, manufacture, assembly and final testing/performance testing. The Quality Plan shall be submitted on electronic media through C-folders, a web based system of NTPC ERP in addition to hard copy, for review and approval. After approval the same shall be submitted in compiled form on CD-ROM (As per format at Annexure-I)</p>			
22.03.00	<p>Field Quality Plans will detail out for all the equipment, the quality practices and procedures etc. to be followed by the Contractor's "Site Quality Control Organisation", during various stages of site activities starting from receipt of materials/equipment at site (As per format at Annexure – II).</p>			
22.04.00	<p>The Bidder shall also furnish copies of the reference documents/plant standards/acceptance norms/tests and inspection procedure etc., as referred in Quality Plans along with Quality Plans. These Quality Plans and reference documents/standards etc. will be subject to Employer's approval without which manufacturer shall not proceed. These approved documents shall form a part of the contract. In these approved Quality Plans, Employer shall identify customer hold points (CHP), i.e. test/checks which shall be carried out in presence of the Employer's Project Manager or his authorised representative and beyond which the work will not proceed without consent of Employer in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Employer along with technical justification for approval and dispositioning.</p>			
22.05.00	<p>The contractor shall submit to the Employer Field Welding Schedule for field welding activities in the format enclosed at Annexure-V. The field welding schedule shall be submitted to the Employer along with all supporting documents, like welding procedures, heat treatment procedures, NDT procedures etc. at least ninety days before schedule start of erection work at site.</p>			
22.06.00	<p>The contractor shall have suitable Field Quality Organization with adequate manpower at Employer's site, to effectively implement the Field Quality Plan (FQP)</p>			
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	<p>and Field Quality Management System for site activities. The contractor shall submit the details of proposed FQA setup (organizational structure and manpower) for employer's approval. The FQA setup shall be in place at least one month before the start of site activities.</p>			
22.07.00	<p>No material shall be dispatched from the manufacturer's works before the same is accepted, by Employer's Project Manager/Authorised representative and duly authorised for dispatch by issuance of Material Dispatch Clearance Certificate (MDCC / CHP Clearance).</p>			
22.08.00	<p>All material used for equipment manufacture including casting and forging etc. shall be of tested quality as per relevant codes/standards. Details of results of the tests conducted to determine the mechanical properties; chemical analysis and details of heat treatment procedure recommended and actually followed shall be recorded on certificates and time temperature chart. Tests shall be carried out as per applicable material standards and/or agreed details</p>			
22.09.00	<p>All welding and brazing shall be carried out as per procedure drawn and qualified in accordance with requirements of ASME Section IX/BS-4870 or other International equivalent standard acceptable to the Employer.</p> <p>All welding/brazing procedures shall be submitted to the Employer or its authorised representative for approval prior to carrying out the welding/brazing.</p>			
22.10.00	<p>All brazers, welders and welding operators employed on any part of the contract either in Contractor's/his sub-contractor's works or at site or elsewhere shall be qualified as per ASME Section-IX or BS-4871 or other equivalent International Standards acceptable to the Employer.</p>			
22.11.00	<p>Welder qualification test results shall be furnished to the Employer for approval. However, where required by the Employer, tests shall be conducted in presence of Employer/authorized representative.</p>			
22.12.00	<p>For all IBR pressure parts and high pressure piping welding, the latest applicable requirements of the IBR (Indian Boiler Regulations) shall also be essentially complied with. However, other piping system ASME B31.1 or other relevant code as applicable shall be followed. Similarly, any other statutory requirements for the equipment/systems shall also be complied with. On all back-gauged welds MPI/LPI shall be carried before seal welding</p>			
22.13.00	<p>All the heat treatment results shall be recorded on time temperature charts and verified with recommended regimes.</p>			
22.14.00	<p>No welding shall be carried out on cast iron components for repair.</p>			
22.15.00	<p>Unless otherwise proven and specifically agreed with the Employer, welding of</p>			
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22.16.00	<p>dissimilar materials and high alloy materials shall be carried out at shop only.</p> <p>All non-destructive examination shall be performed in accordance with written procedures as per International Standards. The NDT operator shall be qualified as per SNT-TC-IA (of the American Society of non-destructive examination) or equivalent. NDT shall be recorded in a report, which includes details of methods and equipment used, result/evaluation, job data and identification of personnel employed and details of co-relation of the test report with the job.</p> <p>In general all plates of thickness greater than 40mm & for pressure parts plates of thickness equal to or greater than 25mm shall be ultrasonically tested otherwise as specified in respective equipment specification. All bar stock/Forging of diameter equal to or greater than 40 mm shall be ultrasonically tested.</p>			
22.17.00	<p>The Contractor shall list out all major items/ equipment/ components to be manufactured in house as well as procured from sub-contractors (BOI). All the sub-contractor proposed by the Contractor for procurement of major bought out items including castings, forging, semi-finished and finished components/equipment etc., list of which shall be drawn up by the Contractor and finalised with the Employer, shall be subject to Employer's approval on enclosed format No. QS-01-QAI-P-01/F3. The contractor's proposal shall include vendor's facilities established at the respective works, the process capability, process stabilization, QC systems followed, experience list, etc. along with his own technical evaluation for identified sub-contractors enclosed and shall be submitted to the Employer for approval within the period agreed at the time of pre-awards discussion and identified in "DR" category prior to any procurement. Monthly progress reports on sub-contractor detail submission / approval shall be furnished preferably on enclosed format at Annexure-IV. Such vendor approval shall not relieve the contractor from any obligation, duty or responsibility under the contract.</p>			
22.17.00a	<p>An indicative list of sub-vendors accepted by NTPC in the past for Corporate Awarded similar packages is enclosed for reference purpose as Indicative Sub-vendors List. The bidders' specific attention is drawn to the 'Disclaimer for the Indicative Vendor List' placed at the start of the Indicative Sub-vendor List. This is attached separately with the QA specification.</p>			
22.18.00	<p>For components/equipment procured by the contractors for the purpose of the contract, after obtaining the written approval of the Employer, the contractor's purchase specifications and inquiries shall call for quality plans to be submitted by the suppliers. The quality plans called for from the sub-contractor shall set out, during the various stages of manufacture and installation, the quality practices and procedures followed by the vendor's quality control organisation, the relevant reference documents/standards used, acceptance level, inspection of documentation raised, etc.</p> <p>Such quality plans of the successful vendors shall be finalised with the Employer</p>			
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	<p>and such approved Quality Plans shall form a part of the purchase order/contract between the Contractor and sub-contractor. With in three weeks of the release of the purchase orders /contracts for such bought out items /components, a copy of the same without price details but together with the detailed purchase specifications, quality plans and delivery conditions shall be furnished to the Employer on the monthly basis by the Contractor along with a report of the Purchase Order placed so far for the contract.</p>			
22.19.00	<p>Employer reserves the right to carry out quality audit and quality surveillance of the systems and procedures of the Contractor's or their sub-contractor's quality management and control activities. The contractor shall provide all necessary assistance to enable the Employer carry out such audit and surveillance.</p>			
22.20.00	<p>The contractor shall carry out an inspection and testing programme during manufacture in his work and that of his sub-contractor's and at site to ensure the mechanical accuracy of components, compliance with drawings, conformance to functional and performance requirements, identity and acceptability of all materials parts and equipment. Contractor shall carry out all tests/inspection required to establish that the items/equipment conform to requirements of the specification and the relevant codes/standards specified in the specification, in addition to carrying out tests as per the approved quality plan.</p>			
22.21.00	<p>Quality audit/surveillance/approval of the results of the tests and inspection will not, however, prejudice the right of the Employer to reject the equipment if it does not comply with the specification when erected or does not give complete satisfaction in service and the above shall in no way limit the liabilities and responsibilities of the Contractor in ensuring complete conformance of the materials/equipment supplied to relevant specification, standard, data sheets, drawings, etc.</p>			
22.22.00	<p>For all spares and replacement items, the quality requirements as agreed for the main equipment supply shall be applicable.</p>			
22.23.00	<p>Repair/rectification procedures to be adopted to make the job acceptable shall be subject to the approval of the Employer/ authorised representative.</p>			
22.24.00	<p>Environmental Stress Screening</p> <p>Environmental stress screening test process / procedure for eliminating infant mortile components for DDCMIS / PLC based system & for other systems having substantial electronics components (as determined by employer) like Electronic transmitter, CCTV components, PA systems etc. shall be furnished for owner acceptance.</p>			
22.25.00	<p>The Contractor / Sub-contractor shall carry out routine test on 100% item at contractor / sub-contractor's works. The quantum of check / test for routine & acceptance test by employer shall be generally as per criteria / sampling plan defined in referred standards. Wherever standards have not been mentioned</p>			
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	quantum of check / test for routine / acceptance test shall be as agreed during detailed engineering stage.			
22.26.00	Software Reliability / Quality Certification Certification from OEM's authorized signatory that software offered with DDCMIS, PLC, CCTV, PA, Pyrometer, CEMS, AAGMS, EQMS, BHMS etc. declaring that the all the offered software(s) had gone through the established software quality test and offered software is not of β -version and offered software is also free from all known bugs as on date of approval of systems documents by NTPC as a part of quality documentation review and approval process during detail engineering.			
23.00.00	QUALITY ASSURANCE DOCUMENTS			
23.01.00	The Contractor shall be required to submit the QA Documentation in two hard copies and two CD ROMs, as identified in respective quality plan with tick (✓)mark.			
23.01.01	Each QA Documentation shall have a project specific Cover Sheet bearing name & identification number of equipment and including an index of its contents with page control on each document.			
	The QA Documentation file shall be progressively completed by the Supplier's sub-supplier to allow regular reviews by all parties during the manufacturing.			
	The final quality document will be compiled and issued at the final assembly place of equipment before dispatch. However CD-Rom may be issued not later than three weeks.			
23.02.00	Typical contents of QA Documentation is as below:-			
	(a.) Quality Plan			
	(b.) Material mill test reports on components as specified by the specification and approved Quality Plans.			
	(c.) Manufacturer / works test reports/results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.			
	(d.) Non-destructive examination results /reports including radiography interpretation reports. Sketches/drawings used for indicating the method of traceability of the radiographs to the location on the equipment.			
	(e.) Heat Treatment Certificate/Record (Time- temperature Chart)			
	(f.) All the accepted Non-conformance Reports (Major/Minor)/deviation, including complete technical details / repair procedure).			
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	(g.) CHP / Inspection reports duly signed by the Inspector of the Employer and Contractor for the agreed Customer Hold Points. (h.) Certificate of Conformance (COC) wherever applicable. (i.) MDCC			
23.03.00	Similarly, the contractor shall be required to submit two sets (two hard copies and two CD ROMs), containing QA Documentation pertaining to field activities as per Approved Field Quality Plans and other agreed manuals/ procedures, prior to commissioning of individual system.			
23.04.00	Before dispatch / commissioning of any equipment, the Supplier shall make sure that the corresponding quality document or in the case of protracted phased deliveries, the applicable section of the quality document file is completed. The supplier will then notify the Inspector regarding the readiness of the quality document (or applicable section) for review. (a.) If the result of the review carried out by the Inspector is satisfactory, the Inspector shall stamp the quality document (or applicable section) for release. (b.) If the quality document is unsatisfactory, the Supplier shall endeavor to correct the incompleteness, thus allowing to finalize the quality document (or applicable section) by time compatible with the requirements as per contract documents. When it is done, the quality document (or applicable section) is stamped by the Inspector. (c.) If a decision is made for dispatch, whereas all outstanding actions cannot be readily cleared for the release of the quality document by that time, the supplier shall immediately, upon shipment of the equipment, send a copy of the quality document Review Status signed by the Supplier Representative to the Inspector and notify of the committed date for the completion of all outstanding actions & submission. The Inspector shall stamp the quality document for applicable section when it is effectively completed. The submission of QA documentation package shall not be later than 3 weeks after the dispatch of equipment.			
23.05.00	TRANSMISSION OF QA DOCUMENTATION On release of QA Documentation by Inspector, one set of quality document shall be forwarded to Corporate Quality Assurance Department and other set to respective Project Site of Employer.			
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	<p>For the particular case of phased deliveries, the complete quality document to the Employer shall be issued not later than 3 weeks after the date of the last delivery of equipment.</p>			
24.00.00	<p>PROJECT MANAGER'S SUPERVISION</p>			
24.01.00	<p>To eliminate delays and avoid disputes and litigation, it is agreed between the parties to the Contract that all matters and questions shall be referred to the Project Manager and without prejudice to the provisions of 'Arbitration' clause in Section GCC, the Contractor shall proceed to comply with the Project Manager's decision.</p>			
24.02.00	<p>The work shall be performed under the supervision of the Project Manager.</p> <p>The scope of the duties of the Project Manager pursuant to the Contract, will include but not be limited to the following:</p> <ul style="list-style-type: none"> (a.) Interpretation of all the terms and conditions of these documents and specifications (b.) Review and interpretation of all the Contractor's drawing, engineering data, etc (c.) Witness or his authorised representative to witness tests and trials either at the manufacturer's works or at site, or at any place where work is performed under the contract (d.) Inspect, accept or reject any equipment, material and work under the contract (e.) Issue certificate of acceptance and/or progressive payment and final payment certificates (f.) Review and suggest modifications and improvement in completion schedules from time to time, and (g.) Supervise Quality Assurance Programme implementation at all stages of the works. 			
25.00.00	<p>INSPECTION, TESTING AND INSPECTION CERTIFICATES</p>			
25.01.00	<p>The word 'Inspector' shall mean the Project Manager and/or his authorised representative and/or an outside inspection agency acting on behalf of the Employer to inspect and examine the materials and workmanship of the works during its manufacture or erection.</p>			
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25.02.00	<p>The Project Manager or his duly authorised representative and/or an outside inspection agency acting on behalf of the Employer shall have access at all reasonable times to inspect and examine the materials and workmanship of the works during its manufacture or erection and if part of the works is being manufactured or assembled on other premises or works, the Contractor shall obtain for the Project Manager and for his duly authorised representative permission to inspect as if the works were manufactured or assembled on the Contractor's own premises or works.</p>			
25.03.00	<p>The Contractor shall give the Project Manager/Inspector fifteen (15) days written notice of any material being ready for testing. Such tests shall be to the Contractor's account except for the expenses of the Inspector's. The Project Manager/Inspector, unless the witnessing of the tests is virtually waived and confirmed in writing, will attend such tests within fifteen (15) days of the date on which the equipment is noticed as being ready for test/inspection failing which the contractor may proceed with test which shall be deemed to have been made in the inspector's presence and he shall forthwith forward to the inspector duly certified copies of test reports in two (2) copies.</p>			
25.04.00	<p>The Project Manager or Inspector shall within fifteen (15) days from the date of inspection as defined herein give notice in writing to the Contractor, or any objection to any drawings and all or any equipment and workmanship which is in his opinion not in accordance with the contract. The Contractor shall give due consideration to such objections and shall either make modifications that may be necessary to meet the said objections or shall inform in writing to the Project Manager/Inspector giving reasons therein, that no modifications are necessary to comply with the contract.</p>			
25.05.00	<p>When the factory tests have been completed at the Contractor's or sub-contractor's works, the Project Manager /Inspector shall issue a certificate to this effect Ten (10) days after completion of tests but if the tests are not witnessed by the Project Manager /Inspectors, the certificate shall be issued within Ten (10) days of the receipt of the Contractor's test certificate by the Project Manager /Inspector. Failure on the part of Project Manager /Inspector to issue such a certificate shall not prevent the Contractor from proceeding with the works. The completion of these tests or the issue of the certificates shall not bind the Employer to accept the equipment should it, on further tests after erection be found not to comply with the contract.</p>			
25.06.00	<p>In all cases where the contract provides for tests whether at the premises or works of the Contractor or any sub-contractor, the Contractor, except where otherwise specified shall provide free of charge such items as labour, material, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Project Manager /Inspector or his authorised representatives to carry out effectively such tests on the equipment in accordance with the Contractor and shall give facilities to the Project Manager/Inspector or to his authorised representative to accomplish testing.</p>			
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25.07.00	The inspection by Project Manager / Inspector and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Contractor in respect of the agreed Quality Assurance Programme forming a part of the contract.			
25.08.00	To facilitate advance planning of inspection in addition to giving inspection notice as specified at clause no 25.03.00 of this chapter, the Contractor shall furnish quarterly inspection programme indicating schedule dates of inspection at Customer Hold Point and final inspection stages. Updated quarterly inspection plans will be made for each three consecutive months and shall be furnished before beginning of each calendar month.			
25.09.00	All inspection, measuring and test equipment used by contractor shall be calibrated periodically depending on its use and criticality of the test/measurement to be done. The Contractor shall maintain all the relevant records of periodic calibration and instrument identification, and shall produce the same for inspection by NTPC. Wherever asked specifically, the contractor shall re-calibrate the measuring/test equipment in the presence of Project Manager / Inspector.			
25.10.00	Associated document for Quality Assurance programme			
25.10.01	Manufacturing Quality Plan Format No. : QS-01-QAI-P-09/F1-R1 enclosed at Annexure-I.			
25.10.02	Field Quality Plan Format No.: QS-01-QAI-P-09/F2-R1 enclosed at Annexure-II.			
25.10.03	List of items requiring quality plan and sub supplier approval. Format No.: QS-01-QAI-P-01/F3-R0 (Annexure-III).			
25.10.04	Status of items requiring Quality Plan and sub supplier approval. Format enclosed at Annexure-IV.			
25.10.05	Field Welding Schedule Format enclosed at Annexure-V.			
25.11.00	Not Used			
25.12.00	DEMONSTRATION OF APPLICATION ENGINEERING			
25.12.01	<p>Based on NTPC inputs, the Contractor shall prepare and submit typical implemented scheme in their system (Control system & HMI) on sample basis. The typical cases to be covered shall include but not be limited to the following.</p> <p>(i) Logics/Loops:</p> <p>a) Drive logics implementation for each type of binary drive along with its display in HMI.</p>			
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	<ul style="list-style-type: none"> b) Sequence implementation along with its display in HMI. c) Single non-cascade controller implementation. d) Cascade loop implementation. e) Master slave implementation with different slave combination. f) Temperature & pressure compensation for flow signals & pressure compensation for level signals as applicable. <p>(ii) HMI Functions:</p> <ul style="list-style-type: none"> a) LVS Annunciation. b) Graphics. c) HSR d) Logs/Reports. e) Calculations (Basic & Performance Calculations). 			
25.12.02	<p>The above typical cases shall be finalized with the Employer through Technical Co-ordination meetings.</p> <p>After review and finalization of the typical cases, the implementation of each logic & control loop shall be carried out by the Contractor based on NTPC inputs. After implementation of these logics & loops, the Contractor shall test each logic /loop and record the observations in a format to be provided by the Employer and demonstrate to Employer at Employer premises during engineering finalization. Any modifications as a result of the demonstration shall be done and documented as part of the test report along with the final scheme. Similarly, HMI functions shall also be demonstrated by the Contractor at Employer premises & the results shall be documented as part of test report.</p>			
25.12.03	<p>During the integrated testing at the Contractor's works, only sample checks shall be done by the Employer for the items covered in above application engineering demonstration.</p>			
26.00.00	<p>PRE-COMMISSIONING AND COMMISSIONING FACILITIES</p>			
26.01.00	<p>(a) As soon as the facilities or part thereof has been completed operationally and structurally and before start-up, each item of the equipment and systems forming part of facilities shall be thoroughly cleaned and then inspected jointly by the Employer and the Contractor for correctness of and completeness of facility or part thereof and acceptability for initial pre-</p>			
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26.01.00	<p>commissioning tests, commissioning and start-up at Site. The list of pre-commissioning tests to be performed shall be as mutually agreed and included in the Contractor's quality assurance programme as well as those included in Part-D, Section-VI and elsewhere in the Technical Specifications.</p> <p>(b) The Contractor's pre-commissioning/ commissioning/start-up engineers, specially identified as far as possible, shall be responsible for carrying out all the pre-commissioning tests at Site. On completion of inspection, checking and after the pre-commissioning tests are satisfactorily over, the commissioning of the complete facilities shall be commenced during which period the complete facilities, equipments shall be operated integral with sub-systems and supporting equipment as a complete plant.</p> <p>(c) All piping system shall be flushed, steam blown, air blown as required and cleanliness demonstrated using acceptable industry standards. Procedures to accomplish this work shall be submitted for approval to the Employer six months prior to the respective implementations. The Employer will approve final verification of cleanliness.</p> <p>(d) The time consumed in the inspection and checking of the units shall be considered as a part of the erection and installation period.</p> <p>(e) The check outs during the pre - commissioning period should be programmed to follow the construction completion schedule. Each equipment/system, as it is completed in construction and turned over to Employer's commissioning (start-up) Engineer(s), should be checked out and cleaned. The checking and inspection of individual systems should then follow a prescribed commissioning documentation [SLs(standard check list)/TS(testing schedule)/CS(commissioning schedule)] approved by the employer.</p> <p>(f) The Contractor during initial operation and performance testing shall conduct vibration testing to determine the 'base line' of performance of all plant rotating equipment. These tests shall be conducted when the equipment is running at the base load, peak load as well as lowest sustained operating condition as far as practicable.</p> <p>Contractor shall furnish the commissioning organization chart for review & acceptance of employer at least twelve months prior to the schedule date of commissioning of 1st unit. The chart should contain:</p> <p>(1.) Biodata including experience of the Commissioning Engineers.</p> <p>(2.) Role and responsibilities of the Commissioning Organisation members.</p> <p>(3.) Expected duration of posting of the above Commissioning Engineers at site.</p>			
<p align="center">LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 38 OF 75</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
26.02.00	<p>Initial Operation</p> <p>(a) On completion of all pre-commissioning activities/ tests and as a part of commissioning the complete facilities shall be put on 'Initial Operation' during which period all necessary adjustments shall be made while operating over the full load range enabling the facilities to be made ready for the Guarantee Tests.</p> <p>(b) The 'Initial Operation' of the complete facility as an integral unit shall be conducted for 720 continuous hours. During the period of initial operation of 720 hours, the FGD System shall operate continuously at full load for a period not less than 72 hours.</p> <p>The Initial Operation shall be considered successful, provided that each item/ part of the facility can operate continuously at the specified operating characteristics, for the period of Initial Operation with all operating parameters within the specified limits and at or near the predicted performance of the equipment/ facility.</p> <p>The Contractor shall intimate the Employer about the commencement of initial operation and shall furnish adequate notice to the Employer in this respect.</p> <p>(c) Any operational interruption in the FGD System due to constraints attributable to the Employer shall be construed as Deemed to be in operation.</p> <p>(d) An Initial Operation report comprising of observations and recordings of various parameters to be measured in respect of the above Initial Operation shall be prepared by the Contractor. This report, besides recording the details of the various observations during initial operation shall also include the dates of start and finish of the Initial Operation and shall be signed by the representatives of both the parties. The report shall have sheets, recording all the details of interruptions occurred, adjustments made and any minor repairs done during the Initial Operation. Based on the observations, necessary modifications/repairs to the plant shall be carried out by the Contractor to the full satisfaction of the Employer to enable the latter to accord permission to carry out the Guarantee tests on the facilities. However, minor defects which do not endanger the safe operation of the equipment, shall not be considered as reasons for with- holding the aforesaid permission.</p>			
26.03.00	<p>Guarantee Tests</p> <p>a) The final test as to prove the Functional Guarantees shall be conducted at Site by the Contractor in presence of the Employer. The contractor's</p>			
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	<p>Commissioning, start-up Engineer shall make the unit ready to conduct such test before start of initial operation. Such test shall be conducted along with the Initial Operations.</p> <p>b) These tests shall be binding on both the parties of the Contract to determine compliance of the equipment with the functional guarantee.</p> <p>c) For performance/ demonstration tests instrumentations, of accuracy class shall be as per specified test codes. The numbers and location of the instruments shall be as per the specified test codes. In addition the values of parameters shall be logged from the information system provided under Employer's Distributed Digital Control Monitoring and Information system. Test will be conducted at specified load points.</p> <p>d) Any special equipment, tools and tackles required for the successful completion of the Guarantee Tests shall be provided by the Contractor, free of cost.</p> <p>e) The Guarantee tests and specific tests to be conducted on equipments have been brought out in detail elsewhere in the specifications.</p>			
27.00.00	<p>TAKING OVER</p> <p>Upon successful completion of Initial Operations and all the tests conducted to the Employer's satisfaction, the Employer shall issue to the Contractor a Taking over Certificate as a proof of the final acceptance of the equipment. Such certificate shall not unreasonably be withheld nor will the Employer delay the issuance thereof, on account of minor omissions or defects which do not affect the commercial operation and/or cause any serious risk to the equipment. Such certificate shall not relieve the Contractor of any of his obligations which otherwise survive, by the terms and conditions of the Contract after issuance of such certificate.</p>			
28.00.00	<p>TRAINING OF EMPLOYER'S PERSONNEL</p>			
28.01.00	<p>Training for Employers O&M Personnel</p> <p>The scope of service under training of Employer's engineers shall include a training module covering upto six (6) man months in the areas of Operation & Maintenance.</p> <p>Such training should enable the personnel to individually take the responsibility of operating and maintaining the FGD system in a manner acceptable to the Employer.</p>			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
28.02.00	<p>Training for Employers Engineering Personnel</p> <p>The scope of services under training for Employer's engineering personnel shall also not necessarily include three (3) man months. This shall cover all disciplines viz, Mechanical, Electrical, C&I, & QA etc. and shall include all the related areas like Design familiarization, training on product design features and product design softwares of major equipment and systems, engineering, manufacturing, erection, commissioning, training on operating features of equipment, quality assurance and testing, plant visits and visits to manufacturer's works, exposure to various kinds of problems which may be encountered in fabrication, manufacturing, erection, welding etc. An indicative module of the training requirement of Employer's Engineering personnel is attached as Annexure-VII.</p>			
28.03.00	<p>Bidder shall furnish in his offer, details of training module(s) covering above requirements which shall be subject to Employer's approval. Consolidated training period included above (i.e. 6 man months and 3 man months respectively for O&M and Engineering) is indicative only. Employer reserves the right to re appropriate the training period between O&M and engineering depending upon the details of training module proposed by the Bidder.</p>			
28.04.00	<p>Exact details, extent of training and the training schedule shall be finalised based on the Bidder's proposal within two (2) months from placement of award.</p>			
28.05.00	<p>In all the above cases, wherever the training of Employer's personnel is arranged at the works of the manufacturer's it shall be noted that the lodging and boarding of the Employer's personnel shall be at the cost of Contractor. The Contractor shall make all necessary arrangements towards the same.</p>			
28.06.00	<p>Take off prices (product wise) should be indicated by the Bidder in the Bid Proposal Sheets. Employer reserves the right to include or exclude these item(s) during placement of Award.</p> <p>Note: For training purposes, one (1) man month implies 30 working days (excluding all intervening holidays) per person.</p>			
29.00.00	<p>SAFETY ASPECTS DURING CONSTRUCTION AND ERECTION</p> <p>In addition to the requirements given in Erection Conditions of Contract (ECC) the following shall also cover:</p> <p>i) Working platforms should be fenced and shall have means of access.</p>			
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30.00.00	ii) Ladders in accordance with Employer's safety rules for construction and erection shall be used. Rungs shall not be welded on columns. All the stairs shall be provided with handrails immediately after its erection.			
31.00.00	NOISE LEVEL The equivalent 'A' weighted sound pressure level measured at a height of 1.5 m above floor level in elevation and at a distance of one (1) metre horizontally from the nearest surface of any equipment/machine, furnished and installed under these specifications, expressed in decibels to a reference of 0.0002 microbar, shall not exceed 85 dBA . However for Ball Mills the noise levels as per following shall also be acceptable: a) Ball Mill 90 dBA			
32.00.00	PACKAGING AND TRANSPORTATION All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. While packing all the materials, the limitation from the point of view of the sizes of railway wagons available in India should be taken account of. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. The Contractor shall ascertain the availability of Railway wagon sizes from the Indian Railways or any other agency concerned in India well before effecting despatch of equipment. Before despatch it shall be ensured that complete processing and manufacturing of the components is carried out at shop, only restricted by transport limitation, in order to ensure that site works like grinding, welding, cutting & preassembly to bare minimum. The Employer's Inspector shall have right to insist for completion of works in shops before despatch of materials for transportation.			
32.01.00	ELECTRICAL EQUIPMENTS/ENCLOSURES All electrical equipments and devices, including insulation, heating and ventilation devices shall be designed for ambient temperature and a maximum relative humidity as specified elsewhere in the specifications.			
33.00.00	INSTRUMENTATION AND CONTROL All instrumentation and control systems/ equipment/ devices/ components, furnished under this contract shall be in accordance with the requirements stated herein, unless otherwise specified in the detailed specifications.			
33.01.00	All instrument scales and charts shall be calibrated and printed in metric units and shall have linear graduation. The ranges shall be selected to have the normal reading at 75% of full scale.			
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CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS																					
	<p>All scales and charts shall be calibrated and printed in Metric Units as follows:</p> <table border="0"> <tr> <td>1. Temperature</td> <td>- Degree centigrade (deg C)</td> </tr> <tr> <td>2. Pressure</td> <td>- Kilograms per square centimetre (Kg/cm²). Pressure instrument shall have the unit suffixed with 'a' to indicate absolute pressure. If nothing is there, that will mean that the indicated pressure is gauge pressure.</td> </tr> <tr> <td>3. Draught</td> <td>- Millimetres of water column (mm wc).</td> </tr> <tr> <td>4. Vacuum</td> <td>- Millimeters of mercury gauge (mm Hg) or water column (mm Wcl).</td> </tr> <tr> <td>5. Flow (Gas)</td> <td>- Tonnes/ hour</td> </tr> <tr> <td>6. Flow (Steam)</td> <td>- Tonnes/ hour</td> </tr> <tr> <td>7. Flow (Liquid)</td> <td>- Tonnes / hour</td> </tr> <tr> <td>8. Flow base</td> <td>- 760 mm Hg. 0 deg.C</td> </tr> <tr> <td>9. Density</td> <td>- Grams per cubic centimeter.</td> </tr> </table>				1. Temperature	- Degree centigrade (deg C)	2. Pressure	- Kilograms per square centimetre (Kg/cm ²). Pressure instrument shall have the unit suffixed with 'a' to indicate absolute pressure. If nothing is there, that will mean that the indicated pressure is gauge pressure.	3. Draught	- Millimetres of water column (mm wc).	4. Vacuum	- Millimeters of mercury gauge (mm Hg) or water column (mm Wcl).	5. Flow (Gas)	- Tonnes/ hour	6. Flow (Steam)	- Tonnes/ hour	7. Flow (Liquid)	- Tonnes / hour	8. Flow base	- 760 mm Hg. 0 deg.C	9. Density	- Grams per cubic centimeter.
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33.02.00	<p>All instruments and control devices provided on panels shall be of miniaturized design, suitable for modular flush mounting on panels with front draw out facility and flexible plan-in connection at rear.</p>																					
33.03.00	<p>All electronic modules shall have gold plated connector fingers and further all input and output modules shall be short circuit proof. These shall also be tropicalised & components shall be of industrial grade or better.</p>																					
34.00.00	<p>ELECTRICAL NOISE CONTROL</p> <p>The equipment furnished by the Contractor shall incorporate necessary techniques to eliminate measurement and control problems caused by electrical noise. Areas in Contractor's equipment which are vulnerable to electrical noise shall be hardened to eliminate possible problems. Any additional equipment, services required for effectively eliminating the noise problems shall be included in the proposal. The equipment shall be protected against ESD as per IEC-61000-2. Radio Frequency interference (RFI) and Electro Magnetic Interference (EMI) protection against hardware damage and control system mal-operations/errors shall be provided for all systems as per EN-50082-2 (1995).</p>																					
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35.00.00	<p>SURGE PROTECTION FOR SOLID STATE EQUIPMENT</p> <p>All solid state systems /equipment shall be able to withstand the electrical noise and surge as encountered in actual service conditions and inherent in a power plant and shall meet the requirements of surge protection as defined in ANSI C37.90.1-1989 on its suitable equivalent class of IEC 254-4. Details of the features incorporated and relevant tests carried out. The test certificates. etc. shall be submitted by the Bidder.</p>			
36.00.00	<p>INSTRUMENT AIR SYSTEM</p> <p>The instrument air supply system as supplied by the Bidder for various pneumatic control & instrumentation devices like pneumatic actuators, power cylinders, E/P converters, piping / tubing etc.</p> <p>Each pneumatic instrument shall have an individual air shut - off valve. The pressure regulating valve shall be equipped with an internal filter, a 50 mm pressure gauge and a built-in filter housing blow down valve.</p>			
37.00.00	<p>TAPPING POINTS FOR MEASUREMENTS</p> <p>Tapping points shall include probes, wherever applicable, for analytical measurements and sampling.</p> <p>For direct temperature measurement of all working media, one stub with internal threading of approved pattern shall be provided along with suitable plug and washer. The Contractor will be intimated about thread standard to be adopted.</p> <p>The following shall be provided on equipment by the Bidder. The standard which is to be adopted, will be intimated to the Contractor.</p> <p>i) Temperature test pockets with stub and thermowell</p> <p>ii) Pressure test pockets</p>			
38.00.00	<p>SYSTEM DOCUMENTATION</p> <p>The Bidder shall provide drawings, system overview & description, hardware/ software details, technical literature, functional & hardware schemes, bill of material, parts list, interconnection diagrams, data sheets, erection/ installation/ commissioning procedures, instruction/ operating manuals, etc. for each of the C& I system / sub-systems/ equipment supplied under this package. The documentation shall include complete details of the C&I systems/ sub-systems/ equipment to enable review by Employer during detailed engineering stage and to provide information to plant personnel for operation & Maintenance (including quick diagnostics & trouble shooting) of these C&I systems/ sub-systems/ equipment at site. The minimum documentation requirements for C&I systems shall be as stipulated under C&I</p>			
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<p>38.01.00</p> <p>39.00.00</p>	<p>"Technical Data Sheets" Part of specifications. In addition to this, system documentation for control system shall include as a minimum to that specified elsewhere in the Technical Specification.</p> <p>The exact format, submission schedule and contents of various documents shall be as finalised during detailed engineering stage.</p> <p>Bill of material (instrument list) for all C&I equipment/ devices shall be furnished by the bidder in standard formats as approved by the Employer.</p> <p>MAINTENANCE MANUALS OF ELECTRONIC MODULES</p> <p>The Contractor shall have to furnish two (2) sets of all maintenance manual of each and every electronic card/module as employed on the various systems and equipment including peripherals etc., offered by him. The Contractor will also have to furnish the data regarding the expected failure rate of various modules and other system components. Further , the contractor shall furnish a set of operating manuals which should include block diagrams ,make, model/type ,details wiring and external connection drawings etc as required to do the testing and maintenance of the electronic modules.</p>			
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	IS:1239 Part-I	Mild steel tubes	(ISO/R 65-1957) (ISO/R-64-1958) (ISO/R-65-1958) (BS 1387 : 1957)	
	IS:1239 Part-II	Mild steel tubulars and other wrought steel pipe fittings	BS 1387 : 1967 BS 1387 :1967 BS 1740 :1965	
	IS:2825	Code for unfired vessels		
	IS:1520	Horizontal centrifugal pumps for clear cold and fresh water		
	IS:1600	Code for practice for performance of constant speed IC Engines for general purpose		
	IS:1601	Specification for performance of constant speed IC Engines for general Purpose		
	IS:1893	Criteria for earthquake resistant design of structures		
	IS1978-1971	Line Pipe April 1969.	API Standards 5L	
	IS:2254-1970	Dimensions of vertical shaft motor for pumps	IEC Pub 72-1 part I NEMA Pub MG 1 1954	
	IS:2266	Steel wire ropes for general engineering purposes	BS :302 : 1968	
	IS:2312	Propellant type Ventilation fans		
	IS:2365	Steel wire suspension ropes for lifts and hoists	BS : 1957	
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	<p>IS:3346</p> <p>IS:3354</p> <p>IS:3401</p> <p>IS:3588</p> <p>IS:3589</p> <p>IS:3677</p> <p>IS:3815</p> <p>IS:3895</p> <p>IS:3963</p> <p>IS:3975</p> <p>IS:4503</p>	<p>Method for the determination of thermal conductivity of thermal insulation materials (two slab guarded hot plate method)</p> <p>Outline dimensions for electric lifts.</p> <p>Silica gel</p> <p>Specification for electrical axial flow fans</p> <p>Electrically welded steel pipes for water, gas and sewage (200mm to 2000 mm Nominal Diametre)</p> <p>Unbonded rock and slag wool for thermal insulation</p> <p>Point hook with shank for general engineering purposes</p> <p>Specification for monocrystalline semiconductor rectifier cells and stacks</p> <p>Roof extractor unit</p> <p>Mild steel wires, strips and tapes for armouring cables</p> <p>Shell and tube type heat Exchanger</p>	<p>DIN 52612 (Deutscher Normenausschuss)</p> <p>ASTM C 163-1964 (American Society of Testing and materials)</p> <p>ASTM C 167-1974</p> <p>ASTM C 177-1963</p> <p>BS 482 - 1968 Doc.:67/3 1284 (Revision of BS 2903) (Issued BS)</p>
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	<p>IS:4540</p> <p>IS:4671</p> <p>IS:4736</p> <p>IS:4894</p> <p>IS:5456</p> <p>IS:5749</p> <p>IS:6392</p> <p>IS:6524 Part-I</p> <p>IS:7098</p> <p>IS:7373</p> <p>IS:7938</p> <p>ISO:1217</p> <p>ASHRAE-33 and air heating coils.</p> <p>ASHRAE-52-76</p>	<p>Specification for monory-stallines rectifire assembly equipment</p> <p>Expanded polystyrene for thermal insulation purpose</p> <p>Hot dip zinc coating on steel tubes</p> <p>Centrifugal fans</p> <p>Code of practice for testing of positive displacement type air compressors and exhauster (For Test Tolerance Only)</p> <p>Forged ramshorn hooks</p> <p>Steel pipe flanges</p> <p>Code of practice for design of tower cranes Static and rail mounted</p> <p>Cross linked Polyethylene insulated PVC sheathed cables</p> <p>Specification for wrought aluminium and aluminium sheet and strips</p> <p>Air receivers for compressed air installation</p> <p>Displacement compressor-Acceptance test</p> <p>Methods of testing for rating of forced circulation air cooling</p> <p>Air cleaning device used in general ventilation for removing particle matter.</p>	<p>Entwurf DIN 15402 Blett 1 Entwurf DIN 15402 BS 3017-1958</p> <p>BS 4504 : 1969</p> <p>BS 2799 : 1956</p> <p>Standard No. 1 to IPCEA (USA) Pub. No. 5-66-524</p>
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	<p>ASHRAE-22-72</p> <p>ASHRAE 23-67</p> <p>ARI-450-6</p> <p>ARI-550</p> <p>ARI-410</p> <p>ARI-430/435 BS:848 (Part-1,2)</p> <p>BS:400</p> <p>BS:401</p> <p>CTI Code ACT-105</p> <p>ANSI-31.5</p> <p>ASME-PTC- 23-1958</p> <p>AMCA A-21C</p> <p>API:618</p> <p>HYDRAULIC INSTITUTE STANDARDS.</p> <p>HYDRANT SYSTEM MANUALS OF TAC.</p> <p>TAC MANUALS OF SPRAY SYSTEM</p> <p>NFPA USA/ NSC UK/ UL USA/ FM USA STANDARDS.</p> <p>INDIAN EXPLOSIVES ACT.</p> <p>INDIAN FACTORIES ACT.</p> <p>STANDARD OF TUBULAR EXCHANGER MANUFACTURER'S ASSOCIATION.</p>	<p>Method of testing for rating of water cooled refrigerant condensers.</p> <p>Methods of testing for rating of positive displacement refrigerant compressors.</p> <p>Standard for water cooled refrigerant condensers.</p> <p>Standard for centrifugal water chilling packages.</p> <p>Standard for forced circulation air cooling and air heating coils</p> <p>Central station AHU/Application of Central Station AHU Fans</p> <p>Low carbon steel cylinders for the storage & transport of permanent gases.</p> <p>Low carbon steel cylinders for the storage & transport of liquified gases.</p> <p>Acceptance test code for Water Cooling Tower.</p> <p>Refrigerant piping</p> <p>Atmospheric Water Cooling Equipment</p> <p>Test Code for air moving devices</p> <p>Reciprocating Compressor for general refinery services.</p>		
<p>LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 50 OF 75</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>CODE AND STANDARD FOR CIVIL WORKS</p> <p>Some of the applicable Standards, Codes and references are as follows:</p> <p>Excavation & Filling</p> <p>IS: 2720 (Part-II, IV TO VIII, XIV, XXI, XXIII, XXIV, XXVII TO XXIX, XL) Methods of test for soils-determination for water content etc.</p> <p>IS: 4701 Code of practice for earth work on canals.</p> <p>IS: 9758 Guide lines for Dewatering during construction.</p> <p>IS: 10379 Code of practice for field control of moisture and compaction of soils for embankment and sub-grade.</p> <p>Properties, Storage and Handling of Common Building Materials</p> <p>IS: 269 Specification for ordinary Portland cement, 33 grade.</p> <p>IS: 383 Specification for coarse and fine aggregates from natural sources for concrete.</p> <p>IS: 432 Specification for mild steel and (Parts 1&2) medium tensile steel bars and hard-drawn steel wires for concrete reinforcement.</p> <p>IS: 455 Specification for Portland slag cement.</p> <p>IS: 702 Specification for Industrial bitumen.</p> <p>IS: 712 Specification for building limes.</p> <p>IS: 808 Rolled steel Beam channel and angle sections.</p> <p>IS: 1077 Specification for common burnt clay building bricks.</p> <p>IS: 1161 Specification of steel tubes for structural purposes.</p> <p>IS: 1363 Hexagon head Bolts, Screws and nuts of production grade C.</p> <p>IS: 1364 Hexagon head Bolts, Screws and Nuts of Production grade A & B.</p> <p>IS: 1367 Technical supply conditions for Threaded fasteners.</p> <p>IS: 1489 Specification for Portland-pozzolana cement: (Part-I) Fly ash based.</p>			
<p align="center">LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 51 OF 75</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	(Part-II) IS: 1542 IS: 1566 IS: 1786 IS: 2062 IS: 2116 IS: 2386 (Parts-I to VIII) IS: 3150 IS: 3495 (Parts-I to IV) IS: 3812 IS: 4031 IS: 4032 IS: 4082 IS: 8112 IS: 8500 IS: 12269 IS: 12894 Cast-In-Situ Concrete and Allied Works IS: 280 IS: 456	Calcined clay based. Specification for sand for plaster. Specification for hard-drawn steel wire fabric for concrete reinforcement. Specification for high strength deformed bars for concrete reinforcement. Specification for steel for general structural purposes. Specification for sand for masonry mortars. Testing of aggregates for concrete. Hexagonal wire netting for general purpose. Methods of tests of burnt clay building bricks. Specification for fly ash, for use as pozzolana and admixture. Methods of physical tests for hydraulic cement. Methods of chemical analysis of hydraulic cement. Recommendations on stacking and storage of construction materials at site. Specification for 43 grade ordinary portland cement. Medium and high strength structural steel. 53 grade ordinary portland cement. Specification for Fly ash lime bricks. Specification for mild steel wire for general engineering purposes. Code of practice for plain and reinforced concrete.	
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9	PART-C GENERAL TECHNICAL REQUIREMENTS	PAGE 52 OF 75


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	IS: 457 IS: 516 IS: 650 IS: 1199 IS: 1791 IS: 1838 (Part-I) IS: 2204 IS: 2210 IS: 2438 IS: 2502 IS: 2505 IS: 2506 IS: 2514 IS: 2645 IS: 2722 IS: 2750 IS: 2751 IS: 3025 IS: 3366 IS: 3370	Code of practice for general construction of plain & reinforced concrete for dams & other massive structures. Method of test for strength of concrete. Specification for standard sand for testing of cement. Methods of sampling and analysis of concrete. General requirements for batch type concrete mixers. Specification for preformed fillers for expansion joints in concrete pavements and structures (non-extruding and resilient type). Code of practice for construction of reinforced concrete shell roof. Criteria for the design of reinforced concrete shell structures and folded plates. Specification for roller pan mixer. Code of practice for bending and fixing of bars for concrete reinforcement. General requirements for concrete vibrators, immersion type. General requirements for concrete vibrators, screed board type. Specification for concrete vibrating tables. Specification for Integral cement water proofing compounds. Specification for portable swing weigh batches for concrete. (single and double bucket type) Specification for Steel scaffolding. Code of practice for welding of mild steel plain and deformed bars for reinforced concrete construction. Methods of sampling and test waste water. Specification for Pan vibrators. Code of practice for concrete structures for the storage of		
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9	PART-C GENERAL TECHNICAL REQUIREMENTS	PAGE 53 OF 75	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	(Part I to IV) IS: 3414 IS: 3550 IS: 3558 concrete. IS: 4014 (Parts I & II) IS: 4326 of buildings. IS: 4461 IS: 4656 IS: 4925 IS: 4990 IS: 4995 (Parts I & II) IS: 5256 IS: 5525 concrete work. IS: 5624 IS: 6461 IS: 6494 IS: 6509 IS: 7861 IS: 9012 IS: 9103	liquids. Code of practice for design and installation of joints in buildings. Methods of test for routine control for water used in industry. Code of practice for use of immersion vibrators for consolidating Code of practice for steel tubular scaffolding. Code of practice for earthquake resistant design and construction Code of practice for joints in surface hydro-electric power stations. Specification for form vibrators for concrete. Specification for batching and mixing plant. Specification for plywood for concrete shuttering work. Criteria for design of reinforced concrete bins for the storage of granular and powdery materials. Code or practice for sealing joints in concrete lining on canals. Recommendations for detailing of reinforcement in reinforced Specification for foundation bolts. Glossary of terms relating to cement concrete. Code of practice for water proofing of underground water reservoirs and swimming pools. Code of practice for installation of joints in concrete pavements. Code of practice for extreme weather concreting. (Parts I & II) Recommended practice for shot concreting. Specification for admixtures for concrete.	
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9	PART-C GENERAL TECHNICAL REQUIREMENTS	PAGE 54 OF 75


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	IS: 9417 IS: 10262 IS: 11384 IS: 11504 IS: 12118 IS: 12200 IS: 13311 Part-1 Part-2 SP:23 SP: 24 SP: 34 Precast Concrete Works SP: 7(PartVI/ IS: 10297 IS: 10505 Masonry and Allied Works IS: 1905 IS: 2212	Recommendations for welding cold worked steel bars for reinforced concrete construction. Recommended guidelines for concrete mix design. Code of practice for composite construction in structural steel and concrete. Criteria for structural design of reinforced concrete natural draught cooling towers. Specification for two-parts poly sulphide. Code of practice for provision of water stops at transverse contraction joints in masonry and concrete dams. Method of non-destructive testing of concrete. Ultrasonic pulse velocity. Rebound hammer. Handbook of concrete mixes Explanatory Handbook on IS: 456-1978 Handbook on concrete reinforcement and detailing. National Building Code- Structural design of prefabrication and Sec.7) systems building. Code of practice for design and construction of floors and roofs using precast reinforced/prestressed concrete ribbed or cored slab units. Code of practice for construction of floors and roofs using pre-cast reinforced concrete units. Code of Practice for Structural Safety of Buildings-Masonry walls. Code of Practice for Brickwork.		
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9	PART-C GENERAL TECHNICAL REQUIREMENTS	PAGE 55 OF 75	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	IS: 2250 SP: 20 Sheeting Works IS:277 IS: 459 IS: 513 IS: 730 IS: 1626 IS: 2527 IS: 3007 IS: 5913 IS: 7178 IS: 8183 IS: 8869 IS: 12093 IS: 12866 IS: 14246 Fabrication and Erection of Structural Steel Work IS: 2016	Code of Practice for Preparation and use of Masonry Mortar. Explanatory hand book on masonry code. Galvanised steel sheets (plain or corrugated). Unreinforced corrugated and semi-corrugated asbestos cement sheets. Cold-rolled carbon steel sheets. Specification for fixing accessories for corrugated sheet roofing. Specification for Asbestos cement building pipes and pipe fittings, gutters and gutter fittings and roofing fittings. Code of practice for fixing rain water gutters and down pipe for roof drainage. Code of practice for laying of asbestos cement sheets. Methods of test for asbestos cement products. Technical supply conditions for tapping screw. Bonded mineral wool. Washers for corrugated sheet roofing. Code of practice for laying and fixing of sloped roof covering using plain and corrugated galvanised steel sheets. Plastic translucent sheets made from thermosetting polyester resin (glass fibre reinforced). Specification for continuously pre-painted galvanised steel sheets and coils. Specification for plain washers.	
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9	PART-C GENERAL TECHNICAL REQUIREMENTS	PAGE 56 OF 75


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	IS: 814 IS: 1852 IS: 3502 IS: 6911 IS: 3757 IS: 6623 IS: 6649 IS: 800 IS: 816 IS: 4000 IS: 9595 IS: 817 IS: 1811 IS: 9178 IS: 9006 IS: 7215 IS: 12843 IS: 4353 SP: 6 (Part 1 to 7)	Specification for covered Electrodes for Metal Arc Welding for weld steel. Specification for Rolling and Cutting Tolerances for Hot rolled steel products. Specifications for chequered plate. Specification for stainless steel plate, sheet and strip. Specification for high strength structural bolts Specification for high strength structural nuts. High Tensile friction grip washers. Code of practice for use of structural steel in general building construction. Code of practice for use of Metal Arc Welding for General Construction. Code of practice for assembly of structural joints using high tensile friction grip fasteners. Code of procedure of Manual Metal Arc Welding of Mild Steel. Code of practice for Training and Testing of Metal Arc Welders. Qualifying tests for Metal Arc Welders (engaged in welding structures other than pipes). Criteria for Design of steel bins for storage of Bulk Materials. Recommended Practice for Welding of Clad Steel. Tolerances for fabrication steel structures. Tolerance for erection of structural steel. Recommendations for submerged arc welding of mild steel and low alloy steels. ISI Hand book for structural Engineers.		
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9	PART-C GENERAL TECHNICAL REQUIREMENTS	PAGE 57 OF 75	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	<p>IS: 1608</p> <p>IS: 1599</p> <p>IS : 228</p> <p>IS : 2595</p> <p>IS : 1182</p> <p>IS : 3664</p> <p>IS : 3613</p> <p>IS : 3658</p> <p>IS : 5334</p> <p>Plastering and Allied Works</p> <p>IS : 1635</p> <p>IS : 1661</p> <p>IS : 2333</p> <p>IS : 2402</p> <p>IS : 2547</p> <p>IS : 3150</p> <p>Acid and Alkali Resistant Lining</p> <p>IS : 158</p> <p>IS : 412</p>	<p>Method of Tensile Testing of Steel products other than sheets, strip, wire and tube.</p> <p>Method of Bend Tests for Steel products other than sheet, strip, wire and tube</p> <p>Methods of chemical Analysis of pig iron, cast iron and plain carbon and low alloy steel.</p> <p>Code of Practice for Radio graphic testing.</p> <p>Recommended practice for Radiographic Examination of fusion welded butt joints in steel plates.</p> <p>Code of practice for Ultra sonic Testing by pulse echo method.</p> <p>Acceptance tests for wire flux combination for submerged Arc Welding.</p> <p>Code of practice for Liquid penetrant Flaw Detection.</p> <p>Code of practice for Magnetic Particle Flaw Detection of Welds.</p> <p>Code of practice for field slaking of Building lime and preparation of putty.</p> <p>Application of cement and cement lime plaster finishes.</p> <p>Plaster-of-paris.</p> <p>Code of practice for external rendered finishes.</p> <p>Gypsum building plaster.</p> <p>Hexagonal wire netting for general purpose.</p> <p>Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali & heat resisting.</p> <p>Specification for expanded metal steel sheets for general purpose.</p>	
<p>LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 58 OF 75</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	IS : 4441 IS : 4443 IS : 4456 IS : 4457 IS : 4832 IS : 4860 IS : 9510	Code of practice for use of silicate type chemical resistant mortars. Code of practice for use of resin type chemical resistant mortars. Method of test for chemical resistant tiles. (Part I & II) Specification for ceramic unglazed vitreous acid resistant tiles. Specification for chemical resistant mortars. Part I Silicate type Part II Resin type Part III Sulphur type Specification for acid resistant bricks. Specification for bitumasitc, Acid resisting grade.		
	Water Supply, Drainage and Sanitation			
	IS : 458 IS : 554 IS : 651 IS : 774 IS : 775 IS : 778 IS : 781 IS : 782 IS : 783	Specification for concrete pipes. Dimensions for pipe threads, where pressure tight joints are made on thread. Specification for salt glazed stoneware pipes. Flushing cisterns for water closets and urinals. Cast iron brackets and supports for wash basins and sinks. Copper alloy gate, globe and check valves for water works purposes. Cast copper alloy screw down bib taps and stop valves for water services. Caulking lead. Code of practice for laying of concrete pipes.		
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9	PART-C GENERAL TECHNICAL REQUIREMENTS	PAGE 59 OF 75	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	IS : 1172 IS : 1230 IS : 1239 IS : 1536 IS : 1537 IS : 1538 IS : 1703 IS : 1726 IS : 1729 IS : 1742 IS : 1795 IS : 1879 IS : 2064 IS : 2065 IS : 2326 IS : 2470 (Part-I & II) IS : 2501 IS : 2548 IS : 2556 (Part 1 to 15) IS : 2963	Basic requirements for water supply, drainage and sanitation. Cast iron rain water pipes and fittings. Mild steel tubes, tubulars and other wrought steel fittings. Centrifugally cast (Spun) iron pressure pipes for water, gas and sewage. Vertically cast iron pressure pipes for water, gas and sewage. Cast iron fittings for pressure pipe for water, gas and sewage. Ball valves (horizontal plunger type) including float for water supply purposes. Cast iron manhole covers and frames. Sand cast iron spigot and socket, soil, water and ventilating pipes, fittings and accessories. Code of practice for building drainage. Pillar taps for water supply purposes. Malleable cast iron pipe fittings. Code of practice for selection, installation and maintenance of sanitary appliances. Code of practice for water supply in building. Automatic flushing cisterns for urinals. Code of practice for installation of septic tanks. Copper tubes for general engineering purposes. Plastic seat and cover for water-closets. Vitreous sanitary appliances (vitreous china). Non-ferrous waste fittings for wash basins and sinks.	
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9	PART-C GENERAL TECHNICAL REQUIREMENTS	PAGE 60 OF 75


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	IS : 3114 IS : 3311 IS : 3438 IS : 3486 IS : 3589 IS : 3989 IS : 4111 (Part I to IV) IS : 4127 IS : 4764 IS : 4827 IS : 5329 IS : 5382 IS : 5822 IS : 5961 IS : 7740 IS : 8931 IS : 8934 IS : 9762 IS : 10446	Code of practice for laying of cast iron pipes. Waste plug and its accessories for sinks and wash basins. Silvered glass mirrors for general purposes. Cast iron spigot and socket drain pipes. Electrically welded steel pipes for water, gas and sewage (200mm to 2000mm nominal diameter). Centrifugally cast (Spun) iron spigot and socket soil, waste and ventilating pipes, fittings and accessories. Code of practice for ancillary structure in sewerage system. Code of practice for laying of glazed stone-ware pipes. Tolerance limits for sewage effluents discharged into inland-surface waters. Electro plated coating of nickel and chromium on copper and copper alloys. Code of practice for sanitary pipe work above ground for buildings. Rubber sealing rings for gas mains, water mains and sewers. Code of practice for laying of welded steel pipes for water supply. Cast iron grating for drainage purpose. Code of practice for road gullies. Cast copper alloy fancy bib taps and stop valves for water services. Cast copper alloy fancy pillar taps for water services. Polyethylene floats for ball valves. Glossary of terms for water supply and sanitation.	
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9	PART-C GENERAL TECHNICAL REQUIREMENTS	PAGE 61 OF 75


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>IS : 10592</p> <p>IS : 12592</p> <p>IS : 12701</p> <p>SP: 35</p> <p>-</p> <p>Doors, Windows and Allied Works</p> <p>IS : 204</p> <p>Part-I</p> <p>Part-II</p> <p>IS : 208</p> <p>IS : 281</p> <p>IS : 362</p> <p>IS : 420</p> <p>IS : 1003 Part-I door</p> <p>IS : 1038</p> <p>IS : 1081</p> <p>IS : 1341</p> <p>IS : 1361</p> <p>IS : 1823</p> <p>IS : 1868</p> <p>IS : 2202 (Part-II)</p>	<p>Industrial emergency showers, eye and face fountains and combination units.</p> <p>Specification for precast concrete manhole covers and frames.</p> <p>Rotational moulded polyethylene water storage tanks.</p> <p>Hand book on water supply and drainage.</p> <p>Manual on Sewerage and sewage treatment (Published by CPH & EEO) As updated.</p> <p>Tower Bolts</p> <p>Ferrous metals.</p> <p>Nonferrous metals.</p> <p>Door Handles.</p> <p>Mild steel sliding door bolts for use with padlocks.</p> <p>Parliament Hinges.</p> <p>Specification for putty, for use on metal frames.</p> <p>Specification for timber panelled and glazed shutters- (Part-I) shutters.</p> <p>Steel doors, windows and ventilators.</p> <p>Code of practice for fixing and glazing of metal (steel and aluminium) doors, windows and ventilators.</p> <p>Steel butt hinges.</p> <p>Steel windows for industrial buildings.</p> <p>Floor door stoppers.</p> <p>Anodic coatings on Aluminium and its alloys.</p> <p>Specification for wooden flush door shutters (solid core type); particle board face panels and hard board face panels</p>		
<p>LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 62 OF 75</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	IS:2209 IS:2553 IS:2835 IS:3548 IS:3564 IS : 3614 IS:4351 IS:5187 IS:5437 IS:6248 IS:6315 IS:7196 IS:7452 IS:10019 IS:10451 IS:10521 R oof Water Proofing and AlliedWorks IS:1203 IS:1322 IS:1346 IS:1580	Mortice locks (vertical type). Safety glass Flat transparent sheet glass. Code of practice for glazing in buildings. Door closers (Hydraulically regulated). Fire check doors; plate, metal covered and rolling type. Steel door frames. Flush bolts. Wired and figured glass Metal rolling shutters and rolling grills. Floor springs (hydraulically regulated) for heavy doors. Hold fasts. Hot rolled steel sections for doors, windows and ventilators. Mild steel stays and fasteners. Steel sliding shutters (top hung type). Collapsible gates. Methods of testing tar and bitumen. Specification for bitumen felts for water proofing and damp proofing. Code of practice for water proofing of roofs with bitumen felts. Specification for bituminous compound for water proofing and caulking purposes.	
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9	PART-C GENERAL TECHNICAL REQUIREMENTS	PAGE 63 OF 75


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	IS:3067	Code of practice for general design details and preparatory work for damp proofing and water proofing of buildings.		
	IS:3384	Specification for bitumen primer for use in water proofing and damp proofing.		
	Floor Finishes and Allied Works			
	IS:1237	Specification for cement concrete flooring tiles.		
	IS:1443	Code of practice for laying and finishing of cement concrete flooring tiles.		
	IS:2114	Code of practice for laying in-situ terrazzo floor finish.		
	IS:2571	Code of practice for laying in-situ cement concrete flooring.		
	IS:3462	Specification for unbacked flexible PVC flooring.		
	IS:4971	Recommendations for selection of industrial floor finishes.		
	IS:5318	Code of practice for laying of flexible PVC sheet and tile flooring.		
	IS:8042	Specification for white portland cement.		
	IS:13801	Specification for chequered cement concrete flooring tiles.		
	Painting and Allied Works			
	IS:162	Specification for fire resisting silicate type, brushing, for use on wood, colour as required.		
	IS:1477	Code of practice for painting of ferrous metals in buildings.		
	Part-I	Pretreatment.		
	Part-II	Painting.		
	IS:1650	Specification for colours for building and decorative finishes.		
	IS:2074	Specification for red oxide-zinc chrome, priming, ready mixed paint air drying.		
	IS:2338	Code of practice for finishing of wood and wood based materials.		
	Part-I	Operations and workmanship		
<p align="center">LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 64 OF 75</p>	

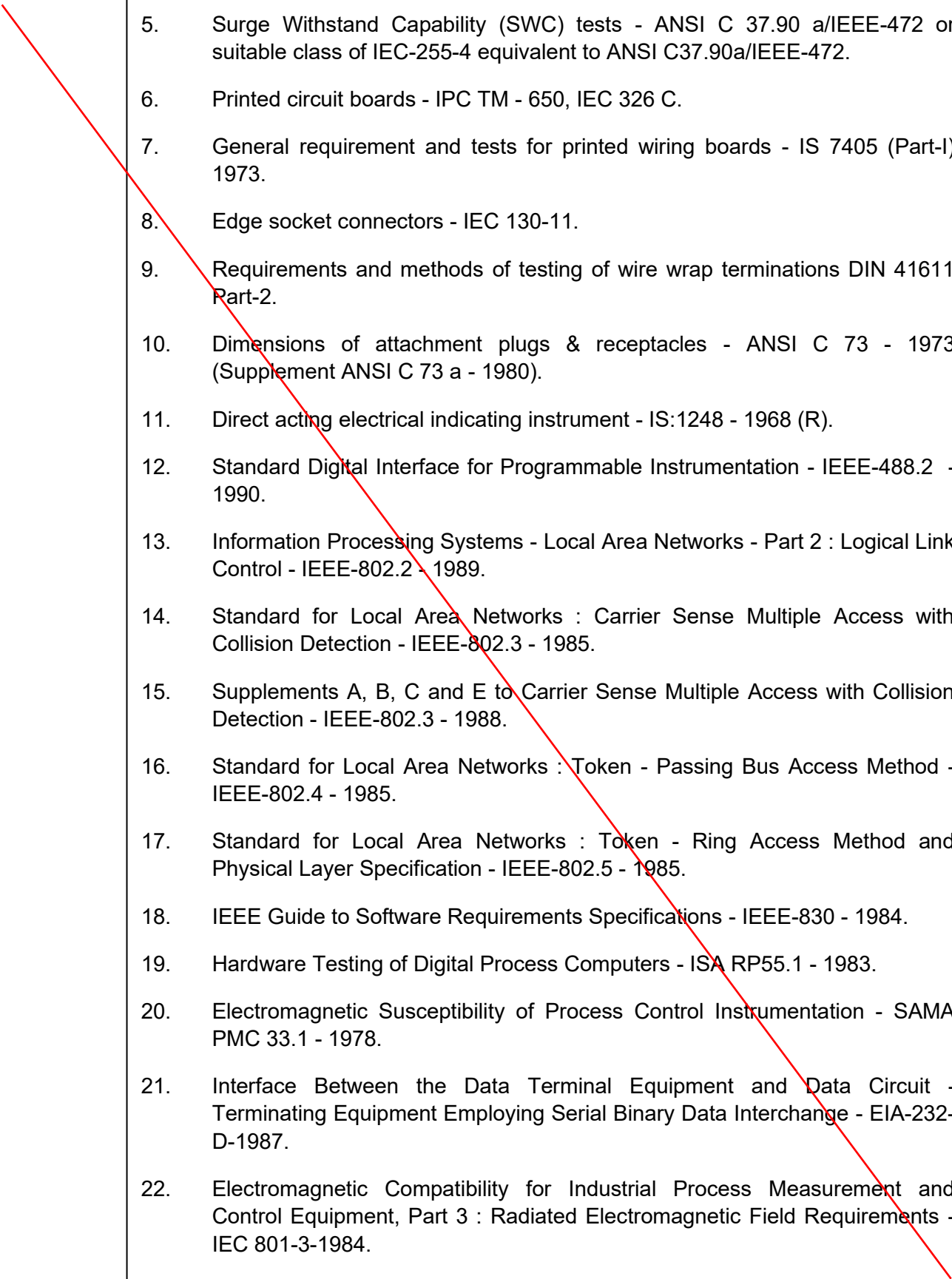
CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	Part-II IS:2395 Part-I Part-II IS:2524 Part-I Part-II IS:2932 IS:2933 IS:4759 IS:5410 IS:5411 (Part-I) IS:6278 IS:10403 Piling and Foundation IS:1080 IS:1904 IS:2911 IS:2950 IS:2974 (Part-I TO V) IS:6403	Schedules Code of practice for painting concrete, masonry and plaster surfaces. Operations and workmanship. Schedule. Code of practice for painting of nonferrous metals in buildings. Pretreatment. Painting. Specification of synthetic enamel paint, exterior, under-coating and finishing. Specification enamel paint, under coating and finishing. Code of practice for hot dip zinc coating on structural steel and other allied products. Specification for cement paint Specification for plastic emulsion paint-for exterior use Code of practices for white washing and colour washing. Glossary of terms relating to building finishes. Code of practice for design and construction of simple spread foundations. Code of practice for design and construction of foundations in Soils; General Requirements. Code of practice for designs and construction of Pile foundations (Relevant Parts). Code of practice for designs and construction of Raft (Part-I) foundation. Code of practice for design and construction of machine foundations. Code of practice for determination of Allowable Bearing pressure on Shallow foundation.		
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9	PART-C GENERAL TECHNICAL REQUIREMENTS	PAGE 65 OF 75	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	IS:8009 Part-I Part-II IS:12070 DIN:4024 VDI:2056 VDI:2060 Stop Log and Trash Rack IS:4622 IS:5620 IS:11388 IS:11855 Roads IRC:5 IRC:14 IRC:16 IRC:19 IRC:21 IRC:34 IRC:36 IRC:37 IRC:56 IRC:73 IRC:86	Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Shallow foundations. Deep foundations. Code of practice for design and construction of shallow foundations on rocks. Flexible supporting structures for machines with rotating machines. Criteria for assessing mechanical vibrations of machines. Criteria for assessing rotating imbalances in machines. Recommendations for fixed - wheel gates structural design. Recommendations for structural design criteria for low head slide gates. Recommendations for design of trash rack for intakes. General requirements for rubber seals for hydraulic gates. Standard specifications and Code of practice for road bridges, section-I general Features of Design. Recommended practice of 2cm thick bitumen and tar carpets. Specification for priming of base course with bituminous primers. Standard specifications and code of practice for water bound macadam. Standard specifications and Code of practice for road bridges, section-III - Cement concrete (plain and reinforced). Recommendations for road construction in waterlogged areas. Recommended practice for the construction of earth embankments for road works. Guidelines for the Design of flexible pavements. Recommended practice for treatment of embankment slopes for erosion control. Geometric design standards for rural (non-urban) highways. Geometric Design standards for urban roads in plains.		
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9	PART-C GENERAL TECHNICAL REQUIREMENTS	PAGE 66 OF 75	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS		
	<p>IRC:SP:13</p> <p>IRC - Public- ation</p> <p>IS:73</p> <p>Loadings</p> <p>IS:875 (Pt. I to V)</p> <p>IS:1893</p> <p>IS:4091</p> <p>IRC:6</p> <p>M.O.T.</p> <p>Safety</p> <p>IS:3696 (Part I & II)</p> <p>IS:3764</p> <p>IS:4081</p> <p>IS:4130</p> <p>IS:5121</p> <p>IS:5916</p> <p>IS:7205</p> <p>IS:7293</p> <p>IS:7969</p> <p>IS:11769</p> <p>- Indian Explosives Act. 1940 as updated.</p> <p>Architectural design of buildings</p> <p>SP:7</p> <p>SP:41</p>	<p>Guidelines for the design of small bridges & culverts.</p> <p>Ministry of Surface Transport (Roads Wing), Specifications for road and bridge works.</p> <p>Specification for paving bitumen</p> <p>Code of practice for design loads other than earthquake) for buildings and structures.</p> <p>Criteria for earthquake resistant design of structures.</p> <p>Code of Practice for design and construction of foundation for transmission line towers & poles.</p> <p>Standard specifications & code of practice for road bridges, Section-II Loads and stresses.</p> <p>Deptt. of railways Bridge Rules.</p> <p>Safety code for scaffolds and ladders.</p> <p>Safety code for excavation work.</p> <p>Safety code for blasting and related drilling operations.</p> <p>Safety code for demolition of buildings.</p> <p>Safety code for piling and other deep foundations.</p> <p>Safety code for construction involving use of hot bituminous materials.</p> <p>Safety code for erection on structural steelwork.</p> <p>Safety code for working with construction machinery.</p> <p>Safety code for handling and storage of building materials</p> <p>Guidelines for safe use of products containing asbestos.</p>	
<p>LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 67 OF 75</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>Miscellaneous</p> <p>IS:802 Code of practice for use of structural steel in (Relevant parts) overhead transmission line towers.</p> <p>IS:803 Code of practice for design, fabrication and erection of vertical mild steel cylindrically welded in storage tanks.</p> <p>IS:10430 Creteria for design of lined canals and liner for selection of type of lining.</p> <p>IS:11592 Code of practice for selection and design of belt conveyors.</p> <p>IS:12867 PVC handrails covers.</p> <p>CIRIA Design and construction of buried thin-wall pipes.</p> <p>Publication</p>			
<p align="center">LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 68 OF 75</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
<div style="position: absolute; top: 50px; left: 50px; width: 800px; height: 750px; border: 2px solid red; transform: rotate(45deg);"></div>	<p>REFERENCE CODES AND STANDARDS FOR CONTROL AND INSTRUMENTATION</p> <p>The design, manufacture, inspection, testing & installation of all equipment and system covered under this specification shall conform to the latest editions of codes and standards mentioned below and all other applicable VDE, IEEE, ANSI, ASME, NEC, NEMA, ISA AND Indian Standards and their equivalents.</p> <p>Temperature Measurements</p> <ol style="list-style-type: none"> 1. Instrument and apparatus for temperature measurement - ASME PTC 19.3 (1974). 2. Temperature measurement - Thermocouples ANSI MC 96.1 - 1982. 3. Temperature measurement by electrical Resistance thermometers - IS:2806. 4. Thermometer - element - Platinum resistance - IS:2848. <p>Pressure Measurements</p> <ol style="list-style-type: none"> 1. a) Instruments and apparatus for pressure measurement - ASME PTC 19.2 (1964). <li style="padding-left: 20px;">b) Electronic transmitters BS:6447. 2. Bourdon tube pressure and vacuum gauges - IS:3624 - 1966. 3. Process operated switch devices (Pr. Switch) BS-6134. <p>Flow Measurements</p> <p>Instruments and apparatus for flow measurements - ASME PTC 19.5 (1972) Interim supplement, Part-II.</p> <p>Measurement of fluid flow in closed conduits - BS-1042.</p> <p>Electronic Measuring Instrument & Control Hardware/ Software</p> <ol style="list-style-type: none"> 1. Automatic null balancing electrical measuring instruments - ANSI C 39.4 (Rev. 1973): IS:9319. 2. Safety requirements for electrical and electronic measuring and controlling instrument - ANSI C 39.5 - 1974. 3. Compatibility of analog signals for electronic industrial process instruments - ISA - S 50.1 (1982) ANSI MC 12.1 - 1975. 4. Dynamic response testing of process control instrumentation ISA - S 26 (1968). 			
	<p align="center">LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 69 OF 75</p>


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	5.	Surge Withstand Capability (SWC) tests - ANSI C 37.90 a/IEEE-472 or suitable class of IEC-255-4 equivalent to ANSI C37.90a/IEEE-472.		
	6.	Printed circuit boards - IPC TM - 650, IEC 326 C.		
	7.	General requirement and tests for printed wiring boards - IS 7405 (Part-I) 1973.		
	8.	Edge socket connectors - IEC 130-11.		
	9.	Requirements and methods of testing of wire wrap terminations DIN 41611 Part-2.		
	10.	Dimensions of attachment plugs & receptacles - ANSI C 73 - 1973 (Supplement ANSI C 73 a - 1980).		
	11.	Direct acting electrical indicating instrument - IS:1248 - 1968 (R).		
	12.	Standard Digital Interface for Programmable Instrumentation - IEEE-488.2 - 1990.		
	13.	Information Processing Systems - Local Area Networks - Part 2 : Logical Link Control - IEEE-802.2 - 1989.		
	14.	Standard for Local Area Networks : Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1985.		
	15.	Supplements A, B, C and E to Carrier Sense Multiple Access with Collision Detection - IEEE-802.3 - 1988.		
	16.	Standard for Local Area Networks : Token - Passing Bus Access Method - IEEE-802.4 - 1985.		
	17.	Standard for Local Area Networks : Token - Ring Access Method and Physical Layer Specification - IEEE-802.5 - 1985.		
	18.	IEEE Guide to Software Requirements Specifications - IEEE-830 - 1984.		
	19.	Hardware Testing of Digital Process Computers - ISA RP55.1 - 1983.		
	20.	Electromagnetic Susceptibility of Process Control Instrumentation - SAMA PMC 33.1 - 1978.		
	21.	Interface Between the Data Terminal Equipment and Data Circuit - Terminating Equipment Employing Serial Binary Data Interchange - EIA-232-D-1987.		
	22.	Electromagnetic Compatibility for Industrial Process Measurement and Control Equipment, Part 3 : Radiated Electromagnetic Field Requirements - IEC 801-3-1984.		
	LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9	PART-C GENERAL TECHNICAL REQUIREMENTS	PAGE 70 OF 75

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>Instrument Switches and Contact</p> <ol style="list-style-type: none"> Contact rating - AC services NEMA ICS 2 - 1978 (with revision through May 1983), Part - 2-125, A6000. Contact rating - DC services NEMA ICS 2-1978 Part-2 125, N600. <p>Enclosures</p> <ol style="list-style-type: none"> Type of Enclosures - NEMA ICS Part - 6 - 1978 (with Rev. 1 4/80) through 110.22 (Type 4 to 13). Racks, panels and associated equipment - EIA : RS - 310 C- 1983 (ANSI C 83.9 - 1972). Protection class for Enclosures, cabinets, control panels & desks - IS:2147 - 1962. <p>Apparatus, enclosures and installation practices in hazardous area</p> <ol style="list-style-type: none"> Classification of hazardous area - NFPA 70 - 1984, Article 500. Electrical Instruments in hazardous dust location - ISA - 512.11, 1973. Intrinsically safe apparatus - NFPA 493 1978. Purged and pressurised enclosure for electrical equipment in hazardous location - NFPA 496-1982. Enclosures for Industrial Controls and Systems - NEMA IS 1.1 - 1977. <p>Sampling System</p> <ol style="list-style-type: none"> Stainless steel material of tubing and valves for sampling system - ASTMA 296-82, Grade 7 P 316. Submerged helical coil heat exchangers for sample coolers ASTM D11 92-1977. Water and steam in power cycle - ASME PTC 19.11. Standard methods of sampling system - ASTM D 1066-99. <p>Annunciators</p> <ol style="list-style-type: none"> Specifications and guides for the use of general purpose annunciators - ISA S 19.1, 1979. Surge withstand capability tests - ANSI C 37.90a - 1989/IEEE-472 or suitable class of IEC 255-4 equivalent to ANSI C37.90a 1989/IEEE-472 Damp heat cycling test - IS:2106 			
<p>LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 71 OF 75</p>	

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>4. Specification for Electromagnetic Susceptibility - SAMA DMC 33, 1/78</p> <p>Protections</p> <ol style="list-style-type: none"> 1. Relays and relay system associated with electric power apparatus. ANSI C 37.90, 1 - 1989. 2. General requirements & tests for switching devices for control and auxiliary circuits including contactor relays - IS:6875 (Part-I) - 1973. 3. Turbine water damage prevention - ASME TDP-1-1980. 4. Boiler safety interlocks - NFPA 85 - 2011 or latest version. <p>UPS System</p> <ol style="list-style-type: none"> 1. Practices and requirements for semi-conductor power rectifiers - ANSI C 34.2, 1973. 2. Relays and relays system associated with electrical power apparatus - ANSI C 3.90 - 1983. 3. Surge withstand capability test - ANSI C 37.90 1 -1989. 4. Performance testing of UPS - IEC 146. 5. Stationary cells & Batteries Lead Acid type (with tubular positive plates) specification IS-1651-1991. 6. Recommended practice for sizing large lead storage batteries for generating stations & sub-stations - IEEE-485-1985. 7. Printed Circuit Board - IPC TM 650, IEC 326C. 8. General Requirements & tests for printed wiring boards, IS:7405 (Part-I) 1973. <p>Control Valves</p> <ol style="list-style-type: none"> 1. Control valve sizing - Compressible & Incompressible fluids - ISA S 75.01-1985. 2. Face to face dimensions of control valves - ANSI B 16.00 - 1973. 3. ISA Hand Book of Control Valves - (ISBN : B: 1047-087664-234-2). 4. Codes for pressure piping - ANSI B 31.1 5. Control Valve leak class - ISA RP 39.6 			
<p align="center">LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 72 OF 75</p>	

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>Process Connection & Piping</p> <ol style="list-style-type: none"> 1. Codes for pressure piping "power piping" - ANSI B 31.1. 2. Seamless carbon steel pipe ASTM - A - 106. 3. Forged & Rolled Alloy steel pipe flanges, forged fittings and valves and parts - ASTM - A - 182. 4. Material for socket welded fittings - ASTM - A - 105. 5. Seamless ferritic alloy steep pipe - ASTM - A - 335. 6. Pipe fittings of wrought carbon steel and alloy steel - ASTM - A - 234. 7. Composition bronze of ounce metal castings - ASTM - B - 62. 8. Seamless Copper tube, bright annealed - ASTM - B - 168. 9. Seamless copper tube - ASTM - B - 75. 10. Dimension of fittings - ANSI - B - 16.11. 11. Valves flanged and butt welding ends - ANSI - B - 16.34. <p>Instrument Tubing</p> <ol style="list-style-type: none"> 1. Seamless carbon steel pipe - ASTM - A 106. 2. Material of socketweld fittings - ASTM - A105. 3. Dimensions of fittings - ANSI - B - 16.11. 4. Code for pressure piping, welding, hydrostatic testing - ANSI B 31.1. <p>Cables</p> <ol style="list-style-type: none"> 1. Thermocouples extension wires/cables - ANSI MC 96.1 - 1992. 2. Requirements for copper conductor-Wiring cables for telecommunications & information processing system - VDE:0815. 3. Colour coding of single or multi-pair cables - ICEA - S - 61-402 (third edition) NEMA WCS - 1979 with revisions throug 2/83. 4. Insulation & Sheathing compounds for cables : VDE 0207 (Part-4, 5 & 6). 5. Guide design and installation of cable systems in power generating stations (insulation, jacket materials) - IEEE Std. 422-1977. 			
<p align="center">LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9</p>	<p align="center">PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p align="center">PAGE 73 OF 75</p>	


CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>6. Rules for Testing insulated cables and flexible cables : VVDE - 0472</p> <p>7. Requirements of vertical flame propagation test - IEEE 383 - 1974 (R 1980)</p> <p>8. Standard specification for tinned soft or annealed copper wire for electrical purpose - ASTM B-33-81.</p> <p>9. Oxygen index and temperature index test - ASTM D - 2863.</p> <p>10. Smoke density measurement test - ASTMD - 2843.</p> <p>11. Acid gas generation test - IEC - 754 - 1.</p> <p>12. Swedish Chimney test - SEN - 4241475 (F3).</p> <p>13. Teflon (FEP) insulation & sheath test - ASTMD - 2116.</p> <p>14. Thermocouple compensating cables - Testing requirements & sampling plan IS:8784.</p> <p>15. PVC insulated electric cables for working voltage upto and including 1100 V - IS:1554 (Part-I).</p> <p>Cable Trays, Conduits</p> <p>1. Guide for design and installation of cable systems in power generating station (Cable trays, support systems, conduits) - IEEE Std. 422, 1977, NEMA VE-1 1979, NFPA 70-1984.</p> <p>2. -do- Test Standards. NEMA VE-1-1979.</p> <p>3. Zinc coating "hot dip" on assembled products for galvanising of carbon steel cable trays - ASTMA - 386-78.</p> <p>Public Address System</p> <p>1. Specifications for loud speakers - IS:7741 (Part-I, II and III)</p> <p>2. Code of safety requirement for electric mains operated audio amplifiers - IS:1301</p> <p>3. Specification for Public Address Amplifiers - IS:10426.</p> <p>4. Code of practice for outdoor installation of PA system - IS:1982.</p> <p>5. Code of practice for installation for indoor amplifying and sound distribution system - IS:1881.</p>			
<p>LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 74 OF 75</p>	

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS			
	<p>6. Basic environmental testing procedures for electronic and electrical items - IS:9000.</p> <p>7. Characteristics and methods of measurements for sound system equipment - IS:9302</p> <p>8. Code of practice of electrical wiring installations (System voltage not exceeding 650 volts) - IS:732</p> <p>9. Rigid steel conduits for electric wiring - IS:9537 (Part-I and II)</p> <p>10. Fittings for rigid steel conduits for electrical wiring - IS:2667</p> <p>11. Degree of protection provided by enclosure for low voltage switchgear and control gear - IS:2147.</p> <p>Vibration Monitoring System</p> <p>1. API 670 - 1994</p> <p>2. BS : 4675 Part-2</p>			
<p>LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9</p>	<p>PART-C GENERAL TECHNICAL REQUIREMENTS</p>	<p>PAGE 75 OF 75</p>	

ANNEXURE-I

MFGR.'s LOGO	MANUFACTURER'S NAME AND ADDRESS	MANUFACTURING QUALITY PLAN		PROJECT :
		ITEM :	QP NO.:	PACKAGE :
		SUB-SYSTEM:	REV.NO.:	CONTRACT NO. :
			DATE:	MAIN-SUPPLIER:
			PAGE: OF....	

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	C / N				D*	M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	** 10.			11.

		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION. AS APPROPRIATE, CHP: NTPC SHALL IDENTIFY IN COLUM "N" AS 'W'	 FOR NTPC USE	DOC. NO.:	REV..... CAT.....
MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER				
SIGNATURE				REVIEWED BY	APPROVED BY
					APPROVAL SEAL

FORMAT NO.: QS-01-QAI-P-09/F1-R1

1/1


ENGG. DIV./QA&I

LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9	PART-C GENERAL TECHNICAL REQUIREMENT	PAGE 76 OF 83
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ANNEXURE-II

SUPPLIER'S LOGO	SUPPLIER'S NAME AND ADDRESS	FIELD QUALITY PLAN		PROJECT :
		ITEM :	QP NO.:	PACKAGE :
		SUB-SYSTEM:	REV. NO.:	CONTRACT NO. :
			DATE:	MAIN-SUPPLIER:
			PAGE: OF....	

S I · N o	ACTIVITY AND OPERATION	CHARACTERISTICS / INSTRUMENTS	CLASS OF CHECK #	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	9.	D* 10.

MANUFACTURER/ SUB-SUPPLIER	MAIN-SUPPLIER	LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. LEGEND TO BE USED: CLASS # : A = CRITICAL, B=MAJOR, C=MINOR; 'A' SHALL BE WITNESSED BY NTPC FQA, 'B' SHALL BE WITNESSED BY NTPC ERECTION / CONSTRUCTION DEPTT. AND 'C' SHALL BE WITNESSED BY MAIN SUPPLIER (A & B CHECK SHALL BE NTPC CHP STAGE)	 FOR NTPC USE	DOC. NO.:		REV.....
				REVIEWED BY	APPROVED BY	APPROVAL SEAL
SIGNATURE						

LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9	PART-C GENERAL TECHNICAL REQUIREMENT	PAGE 77 OF 83
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SUPPLIER'S LOGO	SUPPLIER'S NAME AND ADDRESS	FIELD QUALITY PLAN		PROJECT :
		ITEM :	QP NO.:	PACKAGE :
		SUB-SYSTEM:	REV. NO.:	CONTRACT NO. :
			DATE:	MAIN-SUPPLIER:
			PAGE: OF....	


FORMAT NO.: QS-01-QAI-P-09/F2-R1

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ENGG. DIV./QA&I

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ANNEXURE-III

	Project :	Stage :	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB-SUPPLIER APPROVAL					DOC. NO.:		
	Package :							REV. NO.:		
	Supplier :		SUB-SYSTEM :					DATE :		
	Contractor No. :							PAGE :		OF
S. N.	Item	QP/ Insp. Cat.	QP No.	QP Sub. Schedule	QP approval schedule	Proposed sub-supplier	Place	Sub-suppliers approval status / category	Sub-supplier Details submission schedule	Remarks

LEGENDS**SYSTEM SUPPLIER/SUB-SUPPLIER APPROVAL STATUS CATEGORY (SHALL BE FILLED BY NTPC)**

A – For these items proposed vendor is acceptable to NTPC. To be indicated with letter “A” in the list alongwith the condition of approval, if any.

DR – For these items “Detailed required” for NTPC review. To be identified with letter “DR” in the list.

NOTED – For these items vendors are approved by Main Supplier and accepted by NTPC without specific vendor approval from NTPC. To be identified with “NOTED.”

QP/INSPN CATEGORY:

CAT-I : For these items the Quality Plans are approved by NTPC and the final acceptance will be on physical inspection witness by NTPC.

CAT-II : For these items the Quality Plans approved by NTPC. However no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on the basis review of documents as per approved QP.

CAT-III : For these items Main Supplier approves the Quality Plans. The final acceptance by NTPC shall be on the basis certificate of conformance by the main supplier.

UNITS/WORKS : Place of manufacturing Place of Main Supplier of multi units/works.


FORMAT NO.: QS-01-QAI-P-1/F3-R0

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ANNEXURE-IV

S. N.	Item / Service	QP/ Insp. Cat.	QP Sub. Schedule Approval schedule	Date of submission	Date of comm t Appl.	Status Code C/II/I	Proposed Sub-suppliers	Place of manufacturing works	Approval Status	Sub-supplier detail submission schedule	Remarks	
												Project : Stage :
		Package :	Contractor :		Contractor No. :		REV. NO.:		DATE :		PAGE : OF	
FORMAT												
						1/1			Engg. Div. / QA&I			

LOT-6 PROJECTS
FLUE GAS DESULPHURISATION (FGD)
SYSTEM PACKAGE


TECHNICAL SPECIFICATION
SECTION – VI
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PART-C
GENERAL TECHNICAL REQUIREMENT

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ANNEXURE-V

Sl. No.	DRG No. for Weld Location and Identification mark	Description of parts to welded	Matl. Spec.	Dimensions		Process of welding	Type of Weld	Electrode filler spec.	WPS. No.	Min. pre-heat	Heat treatment		NDT method/ Quantum	REF		Remarks
											Temp.	Holding time		Spec. No.	ACC Norm Ref.	
NOTES:																
SIGNATURE																
FORMAT						1/1						Engg. Div. / QA&I				

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS (Annexure-VI)			
	S.No	Description of Drgs/Docs	No of Prints	No of CD ROMs/DVDs/Portable Hard Disk
	1	Drawings, Data sheets, Design calculations, Purchase specifications and other documents First submission and submission with major changes <ul style="list-style-type: none"> ▪ Layout (A0&A1 sizes) ▪ Other Drawings/Documents (A0&A1 sizes) ▪ P&ID (All sizes) a) Final drawings/documents (Directly to site) b) "As Built" Drawing/Documents (Directly to site) c) Analysis reports of Equipments / piping /structures components/system employing software packages as detailed in the specifications.	4 2 4 6 6 2	- - - 2 2 2
	2	Erection Manual (Directly to site)	4 sets	2
	3	Operation & Maintenance manual	1 set	--
		i) First Submission		
		ii) Final Submission (Directly to site)	4 sets	2
	4	Plant Hand Book	1	1
		i) First Submission		
	5	Commissioning and Performance Test Procedure manual	1 set	--
		i) First Submission		
		ii) Final Submission (Directly to site)	4 sets	2
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9	PART-C GENERAL TECHNICAL REQUIREMENTS Annexure-VI	PAGE 81 OF 83	

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS (Annexure-VI)			
S.No	Description of Drgs/Docs	No of Prints	No of CD ROMs/DVDs/Portable Hard Disk	
6	Performance and Functional Guarantee Test Report i) First Submission	2 sets	—	
	ii) Approved Copies (Direct to Site)	4 sets	2	
7	Project Completion Report (Directly to site)	6 sets	2	
8	QA programme including Organisation for implementation and QA system manual(with revisions)	1	—	
9	Vendor details in respect of proposed vendors including contractor's evaluation report.	2	—	
10	Manufacturing QPs, Field QPs, Field welding schedules and their reference document like test procedures, WPS, POR etc i) For review/comment	1	—	
	ii) Approved final copies of Field QPs, Field welding schedules and their reference document like test procedures, WPS, POR etc (Direct to Site)	4	2	
11	Welding Manual, Heat Treatment Manuals, Storage & preservation manuals i) For review/comment	1 set	—	
	ii) Approved copies (Direct to Site)	4 sets	2	
12	QA Documentation Package for items / equipment manufactured and despatched to site	2 sets	2	
13	QA Documentation Package for field activities on equipment/systems at site	2 sets	2	
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9	PART-C GENERAL TECHNICAL REQUIREMENTS Annexure-VI	PAGE 82 OF 83	

CLAUSE NO.	GENERAL TECHNICAL REQUIREMENTS	ANNEXURE-VII
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PRODUCT	AREAS OF TRAINING REQUIEMENT			
	PRODUCT DESIGN	Plant Visit	Visit to Manufacturer's Work	Operation & Maintenance of Plant
FGD	Layout & model of FGD area, cable & piping trestles etc. FGD <ul style="list-style-type: none"> • Mass balance, Design, selection and sizing calculations of FGD • Training on factors affecting sizing/ efficiency of FGD system, equipments & auxiliaries • Materials for FGD & selection • Basic concepts, Design and sizing calculations on slurry systems including piping, valves, etc.. • FGD electrical system • FGD control system Erection strategies, erection procedures Performance as per applicable code and demonstration tests.	Familiarization with various system and equipment Performance, data collection analysis and review O&M feed back Operation history of various equipments and system Failure analysis	Manufacturing process of Absorber and equipments Welding process Testing facilities Product development in process Future plan for technology induction R&D work in progress	Control philosophy operation, notices, logic & protection schemes, O&M manual familiarization O&M issues. Familiarization of special maintenance techniques Special tool and tackles familiarization
MANMONTH	2	0.5	0.5	6

LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI BID DOC. NO.:CS-0011-109(6)-9	PART-C GENERAL TECHNICAL REQUIREMENTS ANNEXURE-VII	PAGE 83 OF 83
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