





1172900/2022/PS-PEM-MAX

	TITLE: 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-C2B	
		REV. 00	DATE: NOV 222
		SHEET: 1 OF 1	

QUALITY ASSURANCE

CLAUSE NO.	QUALITY ASSURANCE		
<p>1.08.00</p> <p>1.08.01</p> <p>1.08.02</p> <p>1.08.03</p> <p>1.08.04</p> <p>1.08.05</p>	<p>STRUCTURES , DUCTS, HOPPERS:</p> <p>All materials shall be tested for chemical and mechanical properties as per relevant standard. All plates above 40mm shall be 100% ultrasonically tested.</p> <p>Visual inspection of all welds shall be performed in accordance with AWS D1.1.</p> <p>NDT requirements of structural steel welds shall be as under:</p> <ul style="list-style-type: none"> i) 100% RT/UT on butt-welds of plate thickness ≥ 32mm. ii) For plates of $25\text{mm} \leq \text{thickness} < 32\text{mm}$ - 10% RT and 100% MPI. iii) For plates of thickness $< 25\text{mm}$ - 10% MPI/LPI. <p>Edge for shop and field weld shall be examined by MPI for plate thickness ≥ 32mm.</p> <p>Cladding material and its application on the ducts shall be tested as per applicable standard.</p>		
<p>1.09.00</p> <p>1.09.01</p> <p>1.09.02</p> <p>1.09.03</p> <p>1.09.04</p> <p>1.09.05</p>	<p>VACUUM BELT FILTER SYSTEM:</p> <p>Impeller, casing and shaft of vacuum pumps shall be tested for chemical and mechanical properties as per relevant standard. All plates above 40mm shall be 100% ultrasonically tested.</p> <p>UT on shaft (if greater or equal to 40mm) and impeller shall be carried out.</p> <p>All vacuum pumps shall be tested at shop for capacity, power, pressure, efficiency, noise and vibration etc.</p> <p>Filter cloths and belts shall be tested for physical properties as per relevant standard</p> <p>Hydro cyclones shall be checked by visual, dimensional etc.</p>		
<p>1.10.00</p> <p>1.10.01</p> <p>1.10.02</p>	<p>SPRAY NOZZLES:</p> <p>Spray nozzles shall be tested for physical properties</p> <p>Spray nozzles also shall be subjected to performance test.</p>		
<p>1.11.00</p> <p>1.11.01</p> <p>1.11.02</p> <p>1.11.03</p>	<p>AGITATORS:</p> <p>Lining of the agitator shall be tested for hardness and spark test etc. as per applicable standard.</p> <p>Impellers shall be tested for dimensional and balancing check</p> <p>Gear Boxes shall be tested for run test as per standard practice</p>		
<p>1.12.00</p>	<p>FANS:</p>		
<p>LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO:CS-0011-109(6)-9</p>	<p>PART-B SUB-SECTION-V-QM1 FGD SYSTEM</p>	<p>Page 3 of 5</p>

CLAUSE NO.	QUALITY ASSURANCE	
1.12.01	Impeller, casing, blades and shafts of fans shall be tested for chemical and mechanical properties as per relevant standard. All plates above 40mm shall be 100% ultrasonically tested.	
1.12.02	Rotor components shall be subjected to ultrasonic test at mill and magnetic particle inspection / liquid penetrant examination after rough machining.	
1.12.03	Butt welds in rotor components shall be subjected to 100% RT and all welds shall be magnetic particle/dye penetrant tested after stress relieving.	
1.12.04	All rotating components and assemblies of fan shall be balanced dynamically	
1.12.05	Performance test shall be carried out on fans as per Technical specification/ Relevant standard	
1.12.06	Test for Natural Frequency and hardness of Fans blades shall be carried out as per Technical specification/ relevant standard.	
1.13.0	OXIDATION BLOWER	
1.13.01	Impeller, casing, gears and shafts of oxidation blowers shall be tested for chemical and mechanical properties as per relevant standard. All plates above 40mm shall be 100% ultrasonically tested.	
1.13.02	Butt welds in rotor components shall be subjected to 100% RT and all welds shall be magnetic particle/dye penetrant tested after stress relieving (if applicable).	
1.13.03	All rotating components and assemblies of blower shall be balanced dynamically.	
1.13.04	Performance test shall be carried out on blowers as per Technical specification/ relevant standard.	
1.14.00	ABSORBER	
1.14.01	All weld joints shall be tested to suitable NDT techniques as applicable to the materials being welded, joint design & weld profile etc. according to design code/ standard as applicable	
1.14.02	Cladding / Bonding material and its application shall be tested as per applicable standard.	
1.14.03	Absorber fabricated and erected at site shall be subjected to all tests according to design code/ standard as applicable.	
1.15.00	Thermal Insulation, Lagging & Cladding:	
	(a) Lightly resin bonded mineral wool:	
	LRB mattresses/sections of Rockwool/ Glasswool shall conform to & tested as per relevant clauses of Indian Standards and shall meet the requirements of NTPC data sheet. Type tests except Thermal Conductivity shall be regularly carried out once in three months, Thermal Conductivity Type Test shall be carried out minimum once in twelve months by the manufacturer. Requirements of various components like Binding wires, Lacing wires, Wire mesh, etc. shall be as per NTPC approved data sheet / as given in respective Sub-Section of Technical Requirements of Steam Generator & Auxiliaries.	
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO:CS-0011-109(6)-9	PART-B SUB-SECTION-V-QM1 FGD SYSTEM
Page 4 of 5		

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<p>1.16.0</p> <p>1.16.01</p>	<p>(b) Lagging & Cladding:</p> <p>All insulation shall be protected by means of an outer covering of Aluminium sheeting confirming to ASTM B-209-1060 temper H14 from reputed manufacturer meeting the requirements of NTPC data sheet.</p> <p>OTHER CRITICAL EQUIPMENTS:</p> <p>Checks/ NDTs shall be done as per relevant Indian Standards or equivalent International Standards.</p>			
<p>LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO:CS-0011-109(6)-9</p>	<p>PART-B SUB-SECTION-V-QM1 FGD SYSTEM</p>	<p>Page 5 of 5</p>	

QUALITY ASSURANCE

10. Atmospheric Storage Tanks/ Pressure Vessels		Y ^a	Y	Y ^b	Y	Y	Y ^d	Y	Y ^c	Y ^f	
Tests/Check	Material Test	WPS/PQR/Welder Qualification	DPT/MPI	Assembly Fit up	Dimension	RT	Hydraulic / Water Fill	Performance Test	Test as per relevant Std/ Appd. Data Sheets	Other Tests	Remarks
Items / Components											
11. Rubber lining	Y ^a				Y				Y	Y ^g	Y ^f Heat Treatment of the Tank/Vessel shall be done per fabrication code requirement. Welded dished ends shall be stress relieved. Dished ends manufactured by cold working shall also be stress relieved as per the requirement of code.
12. Butterfly valves(HP)	Y ^a			Y	Y		Y	Y			
13. Ball valves(HP)	Y ^a			Y	Y		Y	Y			
12. Resins / Activated Carbon Filter	Y ^a	Y	Y ^b	Y	Y				Y	Y ¹⁰	Y ^g RT as per fabrication code requirements. However, dished ends welds, if manufactured by using welded plates shall be subjected to 100% RT.
13. Hoists & Cranes	Y ^a	Y	Y ^b	Y	Y	Y ^d			Y		Y ^g Rubber Lining Mix shall be subjected to Bleed Resistance Test on mould sample. Adhesion Test, Spark Test and Hardness Test for the Rubber lined jobs shall also be conducted.
14. Agitators /Flash Mixer/ Flocculator	Y ^a	Y	Y ^b	Y	Y			Y		Y ¹⁰	Y ¹⁰ Gear Boxes shall be checked for smooth No Load Operation at shop to verify noise and vibration levels. Gear Ratio and Kerosene Leak Test shall also be conducted.
15. Pipes (Fabricated)	Y ^a	Y	Y	Y	Y	Y	Y		Y		Y ¹¹ One Fan of each type & size shall be routine performance tested as per corresponding code for air flow, static pressure, total pressure, speed, efficiency, power consumption, noise & temperature rise. Also all Fans shall be subjected to run test of 4 hours during which noise, vibration, temperature rise and current drawn shall be measured.
16. Ventilation/Exhaust Fan	Y ^a		Y ^b	Y	Y			Y ¹¹	Y	Y ^{dc}	Y ¹² Dry cycle test on valve spring for 1, 00,000 cycles shall be carried out as type test, if not carried out earlier, for the similar MOC, size and type of spring.
After erection, the complete Piping system along with valves & fittings shall be hydraulically tested at 1.5 times design pressure or 2 times working pressure whichever is higher.											

MINUTES OF MEETING OF POST AWARD DISCUSSIONS HELD VIA TELECONFERENCE ON 13/07/2021 & 01.10.2021 BETWEEN NTPC LTD AND M/s BHEL REGARDING QA&I MATTERS FOR FGD SYSTEM PACKAGE FOR SIPAT -II STPS (2X500MW) FGD PROJECT

BID DOC:CS-0011-109(6)-9

Present:

M/s NTPC Ltd.		M/s BHEL
M K Asthana, GM(QA&I)	S. N. Tripathi, DGM(QA)	M.G.Rajasankar, AGM(Q & BE) BAP Ranipet
B C Roy, AGM(QA)	Satya Narayan, Sr. Manager (QA)	K C Gandhi Parimalam Sr. DGM/QA, BAP Ranipet
Dilip Das, AGM(QA)	Manan Sharma, Sr Manager (QA)	Ritesh Kumar Jaiswal, DGM(Q &BE) PEM
S K Lal, AGM(QA)	Vivek Upadhyay, Sr. Mgr. (QA)	K Renjith Manager/QA, BAP Ranipet
S K Sinha, AGM(QA)	RS Yadav, Manager (QA)	Amit Singh Manager, NTPCBG, PS Mktg.
Nishith Agarwal, AGM(QA)		

Following was discussed and agreed:

1.0 Sub-Contractors/ Sub-Vendors/ Sub-Suppliers:

In exercise of provisions of Cl. 19.1 of GCC (General Conditions of Contract), NTPC-QA will control the items/Systems as listed below, for the purpose of acceptance of their suppliers:

SN.	Item/system	SN.	Item/system
1	Booster Fans	15	Control & Protection Equipment (for Switchyard)
2	Slurry Recirculation Pumps	16	Control & Instrumentation(C&I) Equipment / Systems (DDCMIS, UPS, 24V DC Modular Charger, CEMS & VMS)
3	Oxidation Blowers	17	Oil Free Compressor (CAS)
4	Wet Limestone Grinding Mills	18	Limestone Sampling System
5	Slurry Pumps	19	Gear Box for Limestone/Gypsum handling system
6	Agitators	20	Fluid Coupling for Limestone/Gypsum handling system
7	Vacuum Belt Filters	21	Crusher for Limestone/Gypsum handling system
8	HT Motor- Booster Fan Motor	22	Conveyor belt for Limestone/Gypsum handling system
9	LT Switchgear (Except LDB & WDB)	23	Analyzers for FGD
10	33KV/11KV/6.6KV/3.3KV Switchgears	24	HT Motors (Other than Booster Fan)
11	Numerical relays	25	MV VFD
12	FGD Tie Transformer (100 MVA, 220 kV / 34.5KV Class Transformer or above)	26	Elevator (Gear Type)
13	Auxiliary Oil Filled Transformers (Other than not covered at sl. no. 12)	27	Dry Type Transformers (including the BOI of VFD)
14	Switchyard 132KV/220KV Equipment- {132KV/220KV Circuit Breakers, 132KV/220KV Instrument Transformers (Current Transformers / Voltage Transformers as Applicable), 132KV/220KV Disconnectors, 132KV/220KV Surge Arrestors}	28	HT Cables

The process of vendor approval of the above items shall be as under:

i) Items covered under Sub-QR list, shall call for QA acceptance, of various manufacturing locations of various components/sub-components that constitute the sub-QR equipment, based on the assessment of their facilities, quality management system and experience, as per the systems and procedures of NTPC, in addition to the Sub-QR clearance from NTPC Engineering that the proposed sub vendor meets the sub-qualifying requirements.

ii) For the item not covered under Sub QR but has been listed in above table, NTPC approved vendors shall only be employed by the main contractor. A list of proposed vendors for such items have been placed at Annex-I to this MOM (3 Pages). This list placed at Annex I has been finalized also considering NTPC list of approved sub vendors identified in other NTPC projects. M/s BHEL agreed to comply with the NTPC approval conditions, if any, against each proposal. List of sub vendors placed at Annex I has been drawn with 'A' identified against such vendors previously known to NTPC. M/s BHEL agreed to comply with the NTPC approval conditions, if any, for vendors identified with "A" in this list. For vendor proposals where status of proposal is in "DR" category (details required, as NTPC does not have any past experience with them) in the above mentioned list, M/s BHEL agreed to furnish the following details of such proposals, in NTPC Formats (copies handed over), **in time bound manner, so as not to impede the progress of the Project/ Works -**

- i. Duly Filled Main Supplier Evaluation Report.
- ii. Duly Filled Sub-Supplier Questionnaire.
- iii. Factory Registration Certificate.
- iv. Overall Organization Chart with Manpower details (Design, Manufacturing, Quality etc.)
- v. Supply reference list of the Sub-Supplier indicating similar product supply order reference no., customer name, rating of product, date /year of supply, date / year of commissioning.
- vi. List of Manufacturing Equipment available with sub vendor.
- vii. List of Testing Equipment available with sub vendor.
- viii. Manufacturing process execution plan with flow chart indicating various stages of manufacturing from raw material to finished product including outsourced process, if any.
- ix. Details of Outsourced Manufacturing Processes, if any.
- x. Quality control exercised during receipt, in-process & final inspection.

M/s BHEL will furnish the required details, as detailed out above, of the proposed Manufacturer/ Sub-Vendor, along with their own detailed recommendations, in the NTPC-formats (copies handed over). NTPC informed that proposals/ details shall be received only up to **3 months prior to ordering date of the concerned item (L-2 Network/ BOI Schedule)**, for NTPC review and assessment. M/s BHEL will accordingly plan the submissions.

It is understood that in terms of provisions of Cl. 19.1 of GCC (General Conditions of Contract), in case M/s BHEL opts for additional Vendor proposals, over & above the agreed list herein, may be given by M/s BHEL, in sufficient time, so as not to impede the progress of the work. Accordingly, all such proposals along with required details (as given above), shall be received only up to **3 months prior to ordering date of the concerned item/ Scheduled start of the Manufacture of Self Manufactured Item**, for NTPC review and assessment.

iii) In case the item is not covered under Sub. QR and list of items at sl. No. 1.0 above, the vendors proposed for the same shall be accepted based on Main Contractor's certification regarding past experience with the vendor for supply of similar items. The certification to be submitted to NTPC, before placing the order on the vendor. In case, proposed vendors for such items are not having past experience with Main Contractor, these vendors shall be assessed by the Main Contractor for their capability, and the assessment report shall be submitted to NTPC for reference & record, before placing order on the vendor.



iv) During detailed engineering, NTPC QA will review list of all items to be used for completion of FGD system pkg. Based on its review, NTPC will decide the inspection categorization of all items. There will be 3 inspection category of items –

- a) CAT-I: For these items the Quality Plans are approved by NTPC and the final acceptance will be after physical inspection witness by NTPC.
- b) 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.
- c) CAT-III: For these items Main Contractor approves the Quality Plans. The final acceptance by NTPC shall be on the basis certificate of conformance by the main contractor.

It is clearly understood that NTPC reserves the right to conduct Surveillance Inspection/ Audit of the material, which are identified in Cat-II/ Cat-III, to verify the effectiveness of Quality System of M/s BHEL and conformance of the offered lot, to the applicable Standards/ requirements. It is agreed that M/s BHEL will submit the copies of unpriced Purchase Order (as provided in GTR) of the orders placed on vendors for the items other than those listed in table at Sl. No. 1.0 above, to NTPC for the purpose of surveillance audit, if desired by NTPC, **prior to issue of Dispatch Clearance of the concerned item.**

2.0 The schedule of submission and approval of QP shall be finalized within three weeks of effective date as per LOI/NOA of the contract. The schedule shall be dovetailed with L2 network in such a manner the QP is approved at least 6 weeks prior to scheduled start of manufacturing of the respective item and FQP is approved at least three months before scheduled start of field activity.

3.0 M/s BHEL confirmed that they shall deploy appropriate Batching Plant for producing Concrete, which will be having digitized recording system. This plant shall be calibrated with NPL traceable weights. The plant shall have the facility of delivering the output on recorder, giving separate details of the various constituents (cement, aggregate, water, admixtures, fly ash etc.) in each batch of concrete being produced.

4.0 M/s BHEL confirmed that for Schedule-I/ Schedule-II supplies, orders shall be placed suitably on approved Sub-Vendors' manufacturing location (Foreign/ Indigenous), keeping the Contractual requirements in view.

5.0 M/s BHEL confirmed that the QA Documentation Package shall include copy of approved Data Sheets/ Drawings & QP, along with all Material Test Certificate (MTCs), CHPs, Material Dispatch Clearance Certificate (MDCCs) for all items. The same shall be reviewed by M/s BHEL for its completeness and only thereafter it shall be submitted to NTPC.

6.0 M/s BHEL confirmed that requisite storage facilities for the equipment/materials shall be established by M/s BHEL at site prior to receipt of equipment/material at site, after allotment of land by NTPC. For this purpose, requisite storage plan and schedule for the same shall be agreed between M/s BHEL and NTPC site within 3 months of effective date as per LOI/NOA.


7.0 M/s BHEL confirmed that similar to supply portion of the work, the non-conformities observed during field erection activities shall also be dispositioned according to NTPC's NCR dispositioning system in the prescribed format of NTPC.

(NTPC)





(BHEL)


1172900/2022/PS-PEM-MAX


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		REV. 00	DATE: NOV 222
		SHEET: 1 OF 1	

FUNCTIONAL GUARANTEES

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES				
<p>1.00.00</p> <p>GENERAL</p> <p>The term “Performance Guarantees” wherever appears in the Technical Specifications shall have the same meaning and shall be synonymous to “Functional Guarantees”. Similarly the term “Performance Tests” wherever appears in the Technical Specifications shall have the same meaning and shall be synonymous to “Guarantee Test(s)”.</p> <p>2.00.00</p> <p>PERFORMANCE GUARANTEES / PERFORMANCE TESTS</p> <p>2.01.00</p> <p>General Requirements</p> <p>2.01.01 The Contractor shall guarantee that the equipment offered shall meet the ratings and performance requirements stipulated for various equipment covered in these specifications.</p> <p>2.01.02 The guaranteed performance parameters furnished by the Bidder in his offer, shall be without any tolerance values whatsoever. All margins required for instrument inaccuracies and other uncertainties shall be deemed to have been included in the guaranteed figures. No tolerance or allowance on the test result will be permitted for instrument errors or inaccuracy, the method of testing or any other causes.</p> <p>2.01.03 The Contractor shall conduct performance test and demonstrate all the guarantees covered herein. The various tests which are to be carried out during performance guarantee tests are listed in this Sub-section. The guarantee tests shall be conducted by the Contractor at site in presence of Employer on each unit individually.</p> <p>2.01.04 All costs associated with the tests including cost associated with the supply, calibration, installation and removal of the test instrumentation shall be included in the contract price.</p> <p>2.01.05 The performance tests shall be performed using only the normal number of Employer supplied operating staff. Contractor, vendor or other subcontractor personnel shall be used only for instructional purposes or data collection. At all times during the Performance Tests the emissions and effluents from the Plant shall not exceed the Guaranteed Emission and Effluent Limits.</p> <p>2.01.06 It shall be responsibility of the Contractor to make the plant ready for the performance guarantee tests.</p> <p>2.02.00</p> <p>Test Instrumentation, Flow Measurement and their Calibration</p>	<p>FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES FOR SHORTFALL IN PERFORMANCE AND PERFORMANCE GUARANTEE TESTS</p>	<p>LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-0011-109(6)-9</p>	<p>SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES</p>	<p>PAGE 1 OF 18</p>

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES			
2.02.01	<p>All instruments required for performance testing shall be of the type and accuracy required by the code and prior to the test, the Contractor shall get these instruments calibrated in an independent test Institute approved by the Employer and submit the same to Employer prior to commencement of test. All test instrumentation required for performance tests shall be supplied by the Contractor and shall be retained by him upon satisfactory completion of all such tests at site. All calibration procedures and standards shall be subject to the approval of the Employer prior to commencement of test. The protecting tubes, pressure connections and other test connections required for conducting guarantee test shall conform to the relevant codes.</p> <p>Tools and tackles, thermowells (both screwed and welded) instruments/devices including flow devices, matching flanges, impulse piping & valves etc. and any special equipment, required for the successful completion of the tests, shall be provided by the Contractor free of cost.</p> <p>The Performance test shall be carried out as per the agreed procedure. The detailed PG test procedure shall be submitted within 90 days of the date of Notification of Award and finalization of the PG test procedure shall be done within 180 days from the date of Notification of Award.</p> <p>All test instrumentation, Personal computer(s), necessary server and required interface, software for on line computation of test results & report as required for performance guarantee tests shall be supplied by the contractor and shall be retained by the Employer.</p> <p>Category II guarantees, which shall not possible to demonstrate on line as per agreed PG test procedure, shall be excluded for on line demonstration.</p>			
2.02.02	<p>The P&G test procedures shall be submitted for equipments/system & subsystem under Contractor's scope for all Guarantees as mentioned below, as per latest International codes / standard including correction curves, meeting the specification requirements along with sample calculations & detailed activity plan of preparation (including test instrumentation), conductance and evaluation of Guarantees.</p>			
2.02.03	<p>The Contractor shall submit for Employer's approval the detailed Performance Test procedure containing the following:</p> <ul style="list-style-type: none"> (a) Object of the test. (b) Various guaranteed parameters & tests as per contract. (c) Method of conductance of test and test code. (d) Duration of test, frequency of readings & number of test runs. (e) Method of calculation. 			
<p align="center">LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>		<p align="center">TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-0011-109(6)-9</p>	<p align="center">SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES</p>	<p align="center">PAGE 2 OF 18</p>


CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES		
2.03.00	<p>(f) Correction calculations & curves.</p> <p>(g) Instrument list consisting of range, accuracy, least count, and location of instruments.</p> <p>(h) Scheme showing measurement points.</p> <p>(i) Sample calculation.</p> <p>(j) Acceptance criteria.</p> <p>(k) Any other information required for conducting the test.</p> <p>Test Reports</p> <p>After the conductance of Performance test, the Contractor shall submit the test evaluation report of Performance test results to Employer promptly but not later than one month from the date of conductance of Performance test. Preliminary test reports shall be submitted to the Employer after completing each test run. Four (4) hard copies and two (2) soft copies on CD-ROM of each test report of final conducted test on each equipment/plant/system shall be submitted to Employer for approval.</p>		
2.03.01	Performance Guarantee Tests on the equipments/systems not covered in this Sub-section shall be carried out as per the procedure/test codes specified in respective detailed specifications.		
2.04.00	<p>Acceptance of Guarantee Test Results</p> <p>(i) For Category-I Guarantees</p> <p>In case during performance guarantee test(s) it is found that the equipment/system has failed to meet the guarantees, the Contractor shall carry out all necessary modifications and/or replacements to make the equipment/system comply with the guaranteed requirements at no extra cost to the Employer and re-conduct the performance guarantee test(s) with Employer's consent. In case the specified performance guarantee(s) are still not met but are achieved within the Acceptable Shortfall Limit as specified at clause 3.00.00 of this sub-section, Employer will accept the equipment/system/plant after levying liquidated damages as per clause 3.00.00 of this sub-section. However, if, the demonstrated performance guarantee(s) continue to be beyond the stipulated Acceptable Shortfall Limit, even after the above modifications/replacements within ninety (90) days or a reasonable period allowed by the Employer, after the tests have been completed, the Employer will have the right to either of the following:</p>		
<p>LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-0011-109(6)-9</p>	<p>SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES</p>	<p>PAGE 3 OF 18</p>


CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES			
3.00.00	<p>Reject the equipment / system / plant and recover from the Contractor the payments already made</p> <p style="text-align: center;">OR</p> <p>Accept the equipment /system/ plant after levying Liquidated Damages. The liquidated damages for shortfall in performance indicated in clause 3.00.00 of this sub-section shall be levied separately for each unit. The rates indicated in clause 3.00.00 of this sub-section are on per unit basis. The liquidated damages shall be pro-rated for the fractional parts of the deficiencies.</p> <p>(ii) For Category-II Guarantees</p> <p>In case during performance guarantee test(s) it is found that the equipment/system has failed to meet the guarantees, the Contractor shall carry out all necessary modifications and/or replacements to make the equipment/system comply with the guaranteed requirements at no extra cost to the Employer and re-conduct the performance guarantee test(s) with Employer's consent. In case the specified performance guarantee(s) are still not met even after the above modifications/replacements within ninety (90) days or a reasonable period allowed by the Employer, after the tests have been completed, the Employer will have the right to either of the following:</p> <p>Reject the equipment /system / plant and recover from the Contractor the payments already made.</p> <p style="text-align: center;">OR</p> <p>Accept the equipment/system after assessing the deficiency in respect of the various ratings, performance parameters and capabilities and recover from the contract price an amount equivalent to the damages as determined by the Employer. Such damages shall, however be limited to the cost of replacement of the equipment(s)/system(s), replacement of which shall remove the deficiency so as to achieve the guaranteed performance. These parameters/capacities shall be termed as "Category-II" Guarantees.</p> <p>AMOUNT OF LIQUIDATED DAMAGES (LD) APPLICABLE FOR GUARANTEES FOR EACH PROJECT</p> <p>The rate of liquidated damages and acceptable shortfall limits for different guarantees shall be as under and such liquidated damages shall be deducted from the Contract Price of the project.</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, PART-A BID DOC. NO.:CS-0011-109(6)-9</p>	<p style="text-align: center;">SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES</p>	<p style="text-align: center;">PAGE 4 OF 18</p>	


CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES			एनटीपीसी NTPC
	<u>SIPAT-II (2X500 MW)</u>			
Sl.No	Guarantee	Rate of Liquidated Damage (LD)	Acceptable Shortfall Limit with LD	
i)	SO₂ Removal Efficiency For shortfall in guaranteed SO ₂ removal efficiency in percentage points under conditions stipulated in clause 4.01.00 (i) of Sub-Section-VI, Part A, Section-VI.	INR 2,525,692/- (INR Two Million Five Hundred Twenty Five Thousand Six Hundred Ninety Two only) for every 0.1% point shortfall in SO ₂ removal efficiency from the guaranteed value.	(-)0.25% point from the guaranteed SO ₂ removal efficiency.	
ii)	Limestone Consumption For increase in the limestone consumption of FGD system in Kg/hr under conditions stipulated in clause 4.01.00 (ii) of Sub-Section-VI, Part A, Section-VI.	INR 16,422,350/- (INR Sixteen Million Four Hundred Twenty Two Thousand Three Hundred fifty only) for every 100 kg/hr increase in Limestone consumption from guaranteed value.	(+)10% of the guaranteed limestone consumption.	
iii)	Auxiliary Power Consumption For increase in the auxiliary power consumption in KW guaranteed as per the requirements of clause 4.01.00 (iii), of Sub-Section-VI, Part A, Section-VI.	INR 107,730/- (INR One Hundred Seven Thousand Seven Hundred Thirty only) for every KW increase in Auxiliary power consumption from the guaranteed value.	(+)5% of the guaranteed auxiliary power consumption	
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-0011-109(6)-9	SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES	PAGE 5 OF 18	


CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES			एनटीपीसी NTPC
<u>BARAUNI (2X250 MW)</u>				
	Sl.No	Guarantee	Rate of Liquidated Damage (LD)	Acceptable Shortfall Limit with LD
	i)	SO₂ Removal Efficiency For shortfall in guaranteed SO ₂ removal efficiency in percentage points under conditions stipulated in clause 4.01.00 (i) of Sub-Section-VI, Part A, Section-VI.	INR 2,153,738/- (INR Two Million One Hundred Fifty Three Thousand Seven Hundred Thirty Eight only) for every 0.1% point shortfall in SO ₂ removal efficiency from the guaranteed value.	(-)0.25% point from the guaranteed SO ₂ removal efficiency.
	ii)	Limestone Consumption For increase in the limestone consumption of FGD system in Kg/hr under conditions stipulated in clause 4.01.00 (ii) of Sub-Section-VI, Part A, Section-VI.	INR 30,425,863/- (INR Thirty Million Four Hundred Twenty Five Thousand Eight Hundred Sixty Three only) for every 100 kg/hr increase in Limestone consumption from guaranteed value.	(+)10% of the guaranteed limestone consumption.
	iii)	Auxiliary Power Consumption For increase in the auxiliary power consumption in KW guaranteed as per the requirements of clause 4.01.00 (iii), of Sub-Section-VI, Part A, Section-VI.	INR 215,708/- (INR Two Hundred Fifteen Thousand Seven Hundred Eight only) for every KW increase in Auxiliary power consumption from the guaranteed value.	(+)5% of the guaranteed auxiliary power consumption
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-0011-109(6)-9	SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES	PAGE 6 OF 18	

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES			एनटीपीसी NTPC
	<u>MTPS (2X195 MW)</u>			
	SI.No	Guarantee	Rate of Liquidated Damage (LD)	Acceptable Shortfall Limit with LD
i)	SO₂ Removal Efficiency For shortfall in guaranteed SO ₂ removal efficiency in percentage points under conditions stipulated in clause 4.01.00 (i) of Sub-Section-VI, Part A, Section-VI.	INR 1,703,396/- (INR One Million Seven Hundred Three Thousand Three Hundred Ninety Six only) for every 0.1% point shortfall in SO ₂ removal efficiency from the guaranteed value.		(-)0.25% point from the guaranteed SO ₂ removal efficiency.
ii)	Limestone Consumption For increase in the limestone consumption of FGD system in Kg/hr under conditions stipulated in clause 4.01.00 (ii) of Sub-Section-VI, Part A, Section-VI.	INR 30,872,327/- (INR Thirty Million Eight Hundred Seventy Two Thousand Three Hundred Twenty Seven only) for every 100 kg/hr increase in Limestone consumption from guaranteed value.		(+10% of the guaranteed limestone consumption.
iii)	Auxiliary Power Consumption For increase in the auxiliary power consumption in KW guaranteed as per the requirements of clause 4.01.00 (iii), of Sub-Section-VI, Part A, Section-VI.	INR 204,848 /- (INR Two Hundred Four Thousand Eight Hundred Forty Eight only) for every KW increase in Auxiliary power consumption from the guaranteed value.		(+5% of the guaranteed auxiliary power consumption
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-0011-109(6)-9	SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES	PAGE 7 OF 18	


CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES			
	<u>RIHAND- I (2X500 MW)</u>			
	Sl.No	Guarantee	Rate of Liquidated Damage (LD)	Acceptable Shortfall Limit with LD
	i)	SO₂ Removal Efficiency For shortfall in guaranteed SO ₂ removal efficiency in percentage points under conditions stipulated in clause 4.01.00 (i) of Sub-Section-VI, Part A, Section-VI.	INR 2,517,846/- (INR Two Million Five Hundred Seventeen Thousand Eight Hundred Forty Six only) for every 0.1% point shortfall in SO ₂ removal efficiency from the guaranteed value.	(-)0.25% point from the guaranteed SO ₂ removal efficiency.
	ii)	Limestone Consumption For increase in the limestone consumption of FGD system in Kg/hr under conditions stipulated in clause 4.01.00 (ii) of Sub-Section-VI, Part A, Section-VI.	INR 21,118,247/- (INR Twenty One Million One Hundred Eighteen Thousand Two Hundred Forty Seven only) for every 100 kg/hr increase in Limestone consumption from guaranteed value.	(+)10% of the guaranteed limestone consumption.
	iii)	Auxiliary Power Consumption For increase in the auxiliary power consumption in KW guaranteed as per the requirements of clause 4.01.00 (iii), of Sub-Section-VI, Part A, Section-VI.	INR 164,651/- (INR One Hundred Sixty Four Thousand Six Hundred Fifty One only) for every KW increase in Auxiliary power consumption from the guaranteed value.	(+)5% of the guaranteed auxiliary power consumption
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-0011-109(6)-9	SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES	PAGE 8 OF 18	


CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES			
<p>4.00.00</p> <p>4.01.00</p>	<p>NOTES APPLICABLE FOR EACH PROJECT:</p> <p>i) Each of the liquidated damages specified above shall be independent and these liquidated damages shall be levied concurrently as applicable.</p> <p>ii) All these liquidated damages for short fall in performance shall be deducted from the contract price as detailed in accompanying General Conditions of Contract (GCC)/ Special Conditions of Contract (SCC)</p> <p>iii) Contractor's aggregate liability to pay Liquidated Damages (LD) for failure to attain the functional guarantee shall not exceed twenty five percent (25%) of the Contract Price.</p> <p>iv) The LD values are applicable on per unit basis.</p> <p>GUARANTEES PARAMETERS</p> <p>Guarantees Under Category-I</p> <p>The Performance Guarantees which attract Liquidated Damages (LD) are as follows:</p> <p>The following shall be guaranteed by the Bidder under guarantee point condition of Sub- Section-V, Part-A of section- VI:</p> <p>(i) SO₂ removal Efficiency</p> <p>The Contractor shall guarantee that SO₂ removal efficiency shall not be less than the value specified under guarantee point conditions (as specified in Sub-section-V, Part-A of Section-VI applicable for respective project). (To be conducted as per the stipulation of Cl. no. 6.00.00 of this sub-section.)</p> <p>(ii) Limestone Consumption</p> <p>The Contractor shall guarantee that limestone consumption of FGD system in kg/hr shall not be more than the value specified under guarantee point conditions (as specified in Sub-section-V, Part-A of Section-VI applicable for respective project).</p> <p>(iii) Auxiliary Power Consumption</p> <p>The Contractor shall guarantee that total auxiliary power consumption for the unit in normal operation shall not be more than the value specified under guarantee point conditions (as specified in Sub-section-V, Part-A of Section-VI applicable for complete scope of work for the respective project), inline with the requirements stipulated in clause 5.00.00 of this Sub-Section.</p> <p>iv) Transformer losses</p>			
<p>LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-0011-109(6)-9</p>	<p>SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES</p>	<p>PAGE 9 OF 18</p>	

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES																		
4.02.00	<p>The Contractor shall guarantee that total losses of following FGD Tie transformers & transformers for Owner's use supplied under this contract shall not exceed the values indicated in the table below:</p> <table border="1" data-bbox="483 373 1398 604"> <thead> <tr> <th>S No</th> <th>Project</th> <th>Rating (MVA)</th> <th>Voltage ratio (kV)</th> <th>Total Losses at 75°C : No load loss + Load Loss (@100%) + Aux losses (kW)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Rihand</td> <td>50 MVA</td> <td>132/34 .5</td> <td>208</td> </tr> <tr> <td></td> <td></td> <td>12.5 MVA</td> <td>33/11.5</td> <td>80</td> </tr> </tbody> </table> <p>For fulfilment of guarantee, the maximum losses measured during factory tests shall be considered. The rate of liquidated damages for shortfall in performance shall be as specified for Auxiliary power consumption in Clause 3.00.00 Sub-section-VI, Part-A of Section-VI as applicable for respective project.</p> <p>Guarantees Under Category-II (applicable for Barauni & Kanti)</p> <p>The parameters/capabilities shall be demonstrated for various systems/ equipments shall include but not limited to the following:-</p> <p>(i) Wet ball Mill capacity at rated fineness</p> <p>The contractor shall demonstrate the guaranteed capacity of each limestone pulverizer under the following conditions:</p> <p>i) Limestone Output fineness : 90% or higher (as per the requirement of the absorber) through 325 mesh (for spray tower process) (OR) 90% or higher (as per the requirement of the absorber) through 200 mesh (for bubbling process)</p> <p>ii) Limestone Quality : All available quality from the specified range.</p> <p>(ii) Wet ball Mill wear parts guarantee</p> <p>Contractor shall demonstrate the life of wet ball Mill wear parts in line with requirements stipulated in Part B of the Technical Specification. The establishment of the above guarantee shall be based on the operating records available at the Power station and will be computed for each pulverizer based on actual total hours of operation.</p> <p>(iii) Wet ball Mill ball consumption</p>			S No	Project	Rating (MVA)	Voltage ratio (kV)	Total Losses at 75°C : No load loss + Load Loss (@100%) + Aux losses (kW)	1	Rihand	50 MVA	132/34 .5	208			12.5 MVA	33/11.5	80	
S No	Project	Rating (MVA)	Voltage ratio (kV)	Total Losses at 75°C : No load loss + Load Loss (@100%) + Aux losses (kW)															
1	Rihand	50 MVA	132/34 .5	208															
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LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-0011-109(6)-9	SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES	PAGE 10 OF 18																


CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES		
	<p>Contractor shall guarantee ball consumption per ton of limestone throughput in line with requirements stipulated in Part B of the Technical Specification. Contractor shall furnish the minimum ball diameter below which the balls shall be replaced.</p> <p>(iv) Vacuum Belt Filter Capacity</p> <p>Contractor shall demonstrate the Designed Capacity of the Vacuum Belt Filters to dewater the quantity of gypsum with the specified purity and moisture content as specified in Part B of the Technical Specification.</p> <p>(v) Gypsum Purity</p> <p>The contractor shall demonstrate that the purity of the gypsum produced shall not be less than 90%, chloride content shall not be more than 100ppm and the moisture content shall not be more than 10% for guarantee point condition.</p> <p>(vi) Waste Water</p> <p>The Contractor guarantees that the maximum purge flow rate to waste water treatment system shall be not more than 10m³/hr for 500 MW & 5 m³/hr for 250 MW and below units averaged over a 24 hour period.</p> <p>(vii) Performance characteristics of fans (capacity, head developed, etc.)</p> <p>(viii) Margins on fans in case Booster Fan is provided by the Contractor</p> <p>Booster Fans - As specified in Part B of Technical Specifications</p> <p>(ix) Passenger cum Goods Elevator for FGD absorber & Limestone Grinding Building: Over load tests, travel and hoist speed checks.</p> <p>(x) Noise</p> <p>All the plant, equipment and systems covered under this specification shall perform continuously without exceeding the noise level over the entire range of output and operating frequency specified in Part-C of Section-VI of the technical specifications.</p> <p>Noise level measurement shall be carried out using applicable and internationally acceptable standards. The measurement shall be carried out with a calibrated integrating sound level meter meeting the requirement of IEC 651 or BS 5969 or IS 9779.</p>		
<p>LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-0011-109(6)-9</p>	<p>SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES</p>	<p>PAGE 11 OF 18</p>


CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES	एनटीपीसी NTPC	
	<p>Sound pressure shall be measured all around the equipment at a distance of 1.0 m horizontally from the nearest surface of any equipment/ machine and at a height of 1.5 m above the floor level in elevation.</p> <p>A minimum of 6 points around each equipment shall be covered for measurement. additional measurement points shall be considered based on the applicable standards and the size of the equipment. the measurement shall be done with slow response on the a - weighting scale. the average of a-weighted sound pressure level measurements expressed in decibels to a reference of 0.0002 micro bar shall not exceed the guaranteed value. corrections for background noise shall be considered in line with the applicable standards. all the necessary data for determining these corrections, in line with the applicable standards, shall be collected during the tests.</p> <p>(xi) Mist Outlet Droplet Content</p> <p>The mist eliminator outlet droplet content shall be guaranteed to be ≤ 20 mg/Nm³ at absorber outlet measured over a period of 24 hrs continuous operation.</p> <p>Mist outlet-droplet content shall be measured as per applicable clauses in VDI Norm 3679 and the Contractor shall carry out the tests as per the test procedure approved by the Employer.</p> <p>(xii) Availability of FGD Plant</p> <p>The Contractor shall guarantee the maximum availability of FGD Plant for the range of coal and limestone specified inline with the requirements stipulated in clause 7.00.00 of this Sub-Section</p> <p>(xiii) Air Conditioning System</p> <p>A. Following shall be demonstrated at Shop</p> <ol style="list-style-type: none"> 1) Capacity and static pressure of AHU fans at its rated duty point. <p>B. Following shall be demonstrated at Site</p> <ol style="list-style-type: none"> 1) Capacity (TR) of air cooled condensing units (D-X type) for A/C system of FGD control room building. 2) Guaranteed room conditions during summer for all the Air conditioned areas. 3) Vibration and noise level of condensing units & centrifugal fans of AHUs. 		
<p>LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION - VI, PART-A BID DOC. NO.:CS-0011-109(6)-9</p>	<p>SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES</p>	<p>PAGE 12 OF 18</p>


CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES						
	<p>(xiv) Ventilation System</p> <p>A. Following shall be demonstrated at Shop</p> <ol style="list-style-type: none"> 1) Capacity and discharge pressure of pumps of UAF units at its rated duty point of Ventilation system. 2) Capacity and static pressure of UAF fans at its rated duty point of Ventilation system. <p>B. Following shall be demonstrated at Site</p> <ol style="list-style-type: none"> 1) Vibration & Noise level of centrifugal fans & pumps of UAF units. <p>(xv) Compressed Air System</p> <ol style="list-style-type: none"> a) Following shall be demonstrated at shop: <ol style="list-style-type: none"> i) Capacity and discharge pressure of each air compressor. b) Following shall be demonstrated at site: <ol style="list-style-type: none"> i) Dew point of air at the outlet of air drying plants of air compressor. ii) Pressure drop across air drying plant. iii) Vibration and noise level of air compressors, blowers of air drying plant (if applicable) <p>(xvi) Equipment Cooling Water System</p> <ol style="list-style-type: none"> i) Vibration, noise and parallel operation without hunting & abnormal noise and with flow sharing within 10% of each other at the rated duty point shall be demonstrated at site. ii) Design heat load of plate type heat exchangers and Inlet & Outlet temperatures of the Plate type heat exchangers on the primary and secondary side to be demonstrated at site. Pressure drop across the Plate type heat exchanger on the primary & secondary water circuit to be demonstrated at site. <p>(xvii) Limestone Handling System (applicable for Barauni & Kanti only) and Gypsum Handling System (applicable for all)</p> <ol style="list-style-type: none"> a) Limestone Handling Plant <ol style="list-style-type: none"> (i) The Bidder shall demonstrate the unloading at truck tippler, crushing and conveying to storage shed/silo and then reclaim from storage shed/silos and conveying to mill bunker at the guaranteed capacity including all intermediate equipment & conveyors. (ii) Bidder shall also demonstrate the guaranteed tipping rate of truck tipplers. 			<p>LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-0011-109(6)-9</p>	<p>SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES</p>	<p>PAGE 13 OF 18</p>

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES			
5.00.00	<p data-bbox="479 233 818 264">b) Gypsum Handling Plant</p> <p data-bbox="522 300 1422 365">The Bidder shall demonstrate the guaranteed conveying from belt filter to storage shed/silo including all intermediate equipment & conveyors.</p> <p data-bbox="386 396 1214 426">AUXILIARY POWER CONSUMPTION (PA) FOR EACH PROJECT</p> <p data-bbox="479 443 1422 499">The unit auxiliary power consumption shall be calculated using the following relationship.</p> <p data-bbox="456 529 649 554">Pan = Pun + TLu</p> <p data-bbox="456 585 1422 642">Pan = Guaranteed Auxiliary Power Consumption for unit # n (Where “n” is the unit number e.g. 1, 2,)</p> <p data-bbox="456 672 1154 697">Pun = Power consumed by the auxiliaries of the unit under test</p> <p data-bbox="456 728 1130 753">TLu = Proportional Losses of transformers for one Unit/Block</p> <p data-bbox="456 785 1422 871">TL = Losses of all the transformers supplied by bidder based on works test Reports (excluding FGD Tie transformers(220 kV & 132kV class) & transformers for Owner’s use listed in Clause 4.01.00 iv) as applicable in respective project)</p> <p data-bbox="456 900 818 926">Tlu shall be calculated as below:</p> <p data-bbox="386 963 1422 1029">TLu=(TL / Total MW capacity under the present contract) x (capacity in MW for FGD (unit/block) under test)</p> <p data-bbox="386 1062 1422 1163">While guaranteeing the auxiliary power consumption of each project the bidder shall necessarily include all continuously operating auxiliaries under this package. The auxiliaries to be considered shall include but not be limited to the following:</p> <ol data-bbox="386 1197 1422 1787" style="list-style-type: none"> <li data-bbox="386 1197 1122 1228">i. Absorber Recirculation Pump(s)/Gas Cooling Pumps <li data-bbox="386 1262 881 1293">ii. Absorber Oxidation Air Blower(s) <li data-bbox="386 1327 902 1358">iii. Absorber Oxidation Tank Agitators <li data-bbox="386 1392 764 1423">iv. Gypsum Bleed Pumps <li data-bbox="386 1457 1422 1522">v. Limestone Gravimetric feeder, Wet ball mill and their integral Auxiliaries divided by the number of units in the project <li data-bbox="386 1556 800 1587">vi. Limestone Slurry Pump(s) <li data-bbox="386 1621 1422 1686">vii. Vacuum Belt Filter, Vacuum Pump and its integral auxiliaries divided by the number of units in the project <li data-bbox="386 1719 1422 1785">viii. Power consumption of all working Booster water pumps (if provided) to ACW pumps after PHF divided by the number of units in the project 			
<p data-bbox="228 1881 636 1957">LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p data-bbox="716 1881 984 1957">TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-0011-109(6)-9</p>	<p data-bbox="1040 1871 1247 1967">SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES</p>	<p data-bbox="1279 1906 1409 1929">PAGE 14 OF 18</p>	


CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES	एनटीपीसी NTPC		
	<p>ix. Power consumption of Clarified water pumps (if provided) and Clarified booster water pumps (if provided) divided by the number of units in the project</p> <p>x. Power consumption of Process water pump(s) divided by the number of units in the project</p> <p>xi. Mist Eliminator Wash Water pump(s)</p> <p>xii. Power consumption of Belt Filter Wash Water Pump divided by the number of units in the project</p> <p>xiii. Power consumption of total number of DM Cooling (working) Water pump to supply cooling water on the primary (DM) side of the plate type heat exchangers in the closed loop Equipment cooling water system divided by the number of units (working) in the project</p> <p>xiv. Power consumption of total number of Auxiliary Cooling (working) water pump/Permeate water pump to supply cooling water on the secondary side of the plate type heat exchangers in the closed loop Equipment cooling (unit auxiliary) water system divided by the number of units (working) in the project</p> <p>xv. Booster Fans</p> <p>xvi. Power consumption of Limestone Slurry Tank Agitator(s) divided by the number of units in the project</p> <p>xvii. Power consumption of Filtrate Pump(s) divided by the number of units in the project</p> <p>xviii. Power consumption of Cloth Wash Water Pump divided by the number of units in the project</p> <p>xix. Power consumption of Hydro-cyclone and Waste Water Pump divided by the number of units in the project</p> <p>xx. Power consumption of all other continuous running Agitators divided by the number of units in the project</p> <p>xxi. Air Conditioning System (*)</p> <p>Total Power consumption at motor input terminals of working units (i.e. excluding stand-by) at its rated duty point of compressor and condenser fans of air cooled condensing unit, Air handling unit (AHU) fans for the Air conditioning system of FGD Control Room Building divided by total nos. of units in respective project</p> <p>xxii Total power consumption at motor input terminal at rated duty of fan of UAF divided by total nos. of units in respective project. (*)</p>			
<p>LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-0011-109(6)-9</p>	<p>SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES</p>	<p>PAGE 15 OF 18</p>	

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES					
6.00.00	<p>(*) Above guaranteed power consumption values shall be at 20 deg C for centrifugal fans of AHUs and at 30 deg C for centrifugal fans of UAF units and at an elevation of RL (referring to GLP of respective projects) for both AHUs and UAF centrifugal fans.)</p> <p>xxiii Total power consumption at motor input terminal at rated duty of Air compressor, Air drying plant (Heater and blower, as applicable) divided by total nos. of units in respective project.</p> <p>xxviii. Power consumption for all the equipment's including auxiliaries with single stream operation of lime stone handling, crushing and gypsum handling plant as applicable at its guaranteed flow path capacity in T/Hr shall be considered. Loading factor to be considered as 0.25 for lime stone handling and crushing plant equipment and 1 for Gypsum handling plant.</p> <p>For APC following equipment shall be considered in general for material handling system: Truck Tippler with Box feeder/Bulk material receiving unit/ /Surface Feeder, Paddle Feeder/Apron Feeder (as applicable), Vibrating feeders, Belt Conveyors and Belt Feeders, Bucket Elevators, Reversible belt feeder/Plough feeder, Travelling tripper, Any other equipment not included under exclusion.</p> <p>Following equipment shall be under exclusion for purpose of APC: Lighting, Hoist, Lime Sampling unit, Sump Pumps, Elevators, DS, DE, SW System and Potable water</p> <p>NOTE:</p> <ol style="list-style-type: none"> The equipment's listed above for calculating auxiliary power consumption are indicative. Any other equipment required for continuous operation of the system shall also be considered for calculation of auxiliary power consumption. Power consumption of all equipments provided on unitized basis shall be included in the unit auxiliary power consumption. For common station auxiliaries, the power consumption shall be assigned to each unit based on unit load for the purpose of calculating the unit auxiliary power consumption. The bidder shall furnish a list of equipments to be covered under auxiliary power consumption, which shall be subject to Employer's approval. Transformer losses (TL) shall be considered as per following (as applicable)- FGD HT/Aux/LT Outdoor/ LT Indoor Transformer: 100 % No load loss and 25 % of Copper Losses. Auxiliary power shall be measured without SCR (De-NOx) system. Auxiliary power shall be measured at the switchgear of the drives. <p>METHOD OF COMPUTING TEST EFFICIENCY OF FGD</p>		LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION - VI, PART-A BID DOC. NO.:CS-0011-109(6)-9	SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES	PAGE 16 OF 18

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES			
7.00.00	<p>The performance tests shall be carried out in accordance with ASME PTC 40 (2017) code. No tolerance or allowance on the test result will be permitted for instrument errors or inaccuracy, the method of testing or any other causes. The details of the test shall, however be mutually agreed upon between the employer and the contractor.</p> <p>METHOD OF COMPUTING AVAILABILITY</p> <p>The Contractor shall guarantee 98 % availability of FGD plant for a continuous period of 120 days. An availability guarantee test shall be conducted to assure this level of availability for a period of 240 days as per the procedure indicated below.</p> <p>Availability 'A' in %:</p> $A = \frac{T_c \times 100\%}{T_k}$ <p>T_c – recorded time of FGD operation, expressed in hours, T_k – recorded time of boiler operation, expressed in hours,</p> <p>However, it is required that:</p> <p>(i) In order to calculate the FGD availability, operation hours will be counted except boiler start-ups when the operation hours counting will start on the moment of shut down of all oil burners,</p> <p>(ii) FGD will be regarded as a FGD in operation, when by-pass damper is closed and total flow of flue gas from boiler goes via FGD, and SO₂ content is as below in cleaned flue gas for the range of specified coals & loads:</p> <p>(a) 200 mg/Nm³ (6% O₂ dry) for units having capacity of 500 MW and MTPS Unit #3</p> <p>(b) 100 mg/Nm³ (6% O₂ dry) for Barauni (2x250 MW) & MTPS Unit #4</p> <p>If FGD is out of operation during the boiler operation time as a result of the Employer's decision, this time will not be counted as boiler operation time for calculating the FGD availability,</p> <p>(iv) Boiler operation hours will be counted based on the recorded boiler operation hours and the recorded data will be made available to the Contractor by the Employer.</p> <p>Mandatory spares have been identified in the Employer. Contractor can use the mandatory spares supplied under the contract during this period in agreement with the Employer. However, if other additional spares are</p>			
<p>LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-0011-109(6)-9</p>	<p>SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES</p>	<p>PAGE 17 OF 18</p>	


CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES			
	<p>required for demonstration of availability demonstration guarantee, Bidder to should clearly indicate along with their offer.</p> <p>If the calculated availability after 120 days availability test is lower than the guaranteed value, the Contractor will undertake actions as per clause 2.04.00 (ii) of this Sub-Section to achieve the guaranteed availability.</p>			
<p>LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-0011-109(6)-9</p>	<p>SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES</p>	<p>PAGE 18 OF 18</p>	


1172900/2022/PS-PEM-MAX

	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-C2C	
		REV. 00	DATE: NOV 222
		SHEET: 1 OF 1	

PAINING SPECIFICATION

CLAUSE NO.	TECHNICAL REQUIREMENTS		
1.00.00	SPECIFICATION OF SURFACE PREPARATION & PAINTING		
1.01.00	Surface preparation methods and paint/primer materials shall be of the type specified herein. If the contractor desires to use any paint/primer materials other than that specified, specific approval shall be obtained by the contractor in writing from the employer for using the substitute material.		
1.02.00	All paints shall be delivered to job site in manufacturers sealed containers. Each container shall be labelled by the manufacturer with the manufacturer's name, type of paint, batch number and colour.		
1.03.00	Unless specified otherwise, paint shall not be applied to surfaces of insulation, surfaces of stainless steel/nickel/ copper/brass/ monel/ aluminum/ hastelloy/lead/ galvanized steel items, valve stem, pump rods, shafts, gauges, bearing and contact surfaces, lined or clad surfaces.		
1.04.00	All pipelines shall be Colour coded for identification as per the NTPC Colour-coding scheme, which will be furnished to the contractor during detailed engineering.		
1.05.00	SURFACE PREPARATION		
1.05.01	All surfaces to be painted shall be thoroughly cleaned of oil. Grease and other foreign material. Surfaces shall be free of moisture and contamination from chemicals and solvents.		
1.05.02	<p>The following surface preparation schemes are envisaged here. Depending upon requirement any one or a combination of these schemes may be used for surface preparation before application of primer.</p> <p>SP1 Solvent cleaning</p> <p>SP2 Application of rust converter (Ruskil or equivalent grade)</p> <p>SP3 Power tool cleaning</p> <p>SP4 Shot blasting (shot blasting shall be used as surface preparation method for hot worked pipes prior to application of primer)</p> <p>SP4* Shot blast cleaning/ abrasive blast cleaning to SA21/2 (near white metal) 35-50 microns</p> <p>SP5 Shot blasting/ abrasive blasting.</p> <p>SP6 Emery sheet cleaning/Manual wire brush cleaning.</p>		
1.06.00	APPLICATION OF PRIMER/PAINT		
1.06.01	The paint/primer manufacturer's instructions covering thinning, mixing, method of application, handling and drying time shall be strictly followed and considered as part of this specification. The Dry film thickness (DFT) of primer/paint shall be as specified herein.		
1.06.02	Surfaces prepared as per the surface preparation scheme indicated herein shall be applied with primer paint within 6 hours after preparation of surfaces.		
1.06.03	Where primer coat has been applied in the shop, the primer coat shall be carefully examined, cleaned and spot primed with one coat of the primer before applying intermediate and finish coats. When the primer coat has not been applied in the shop, primer coat shall be applied by brushing, rolling or spraying on the same day		

CLAUSE NO.	TECHNICAL REQUIREMENTS	
	<p>as the surface is prepared. Primer coat shall be applied prior to intermediate and finish coats.</p>	
1.06.04	<p>Steel surfaces that will be concealed by building walls shall be primed and finish painted before the floor is erected. Tops of structural steel members that will be covered by grating shall be primed and finish painted before the grating is permanently secured.</p>	
1.06.05	<p>Following are the Primer/painting schemes envisaged herein:</p> <p>PS3 - Zinc Chrome Primer (Alkyd base) by brush/Spray to IS104.</p> <p>PS3* - Zinc Chrome primer (Alkyd base) by dip coat.</p> <p>PS4 - Synthetic Enamel (long oil alkyd) to IS2932.</p> <p>PS5 - Red Oxide Zinc Phosphate primer (Alkyd base) to IS 12744</p> <p>PS9 - Aluminium paint to IS 2339.</p> <p>PS9* - Heat resistant Aluminium paint to IS-13183 Gr.-1</p> <p>PS13 - Rust preventive fluid by spray, dip or brush.</p> <p>PS14 - weldable primer-Deoxaluminat or equivalent.</p> <p>PS16 - High Build Epoxy CDC mastic `15` .</p> <p>PS17 - Aliphatic Acrylic Polyurethane CDE134 ,%V=40.0(min.)</p> <p>PS18 - Epoxy based TiO2 pigmented coat</p> <p>PS19 - Epoxy Zinc rich primer (92% zinc in dry film (min.), %VS=40.0(min.)</p> <p>PS-20 - Epoxy based finish paint</p>	
1.06.06	<p>All weld edge preparation for site welding shall be applied with one coat of weldable primer.</p>	
1.06.07	<p>For internal protection of pipes/tubes, VCI pellets shall be used at both ends after sponge testing and ends capped. VCI pellets shall not be used for SS components and composite assemblies.</p>	
1.06.08	<p>SG membrane walls and other Flue gas swept pressure part surfaces shall be applied with appropriate primer for protection of surfaces during transit, storage and erection.</p>	
1.06.09	<p>a) All un-insulated equipments, pipes, valves etc covered in sub-section A-08 (Steam Turbine & Auxiliary system) shall be painted with paint not inferior to Epoxy resin based paints with minimum DFT of 150 micron.</p> <p>The paint shall be applied in three stages i.e. primer, intermediate and finish coats in following manner:</p> <ul style="list-style-type: none"> ▪ Primer coat – Epoxy based zinc phosphate ▪ Intermediate - Epoxy based TiO2 pigmented coat ▪ Finish coat - Epoxy based finish coat <p>b) Equipment, pipes etc. with high temperature shall be painted with heat resistant aluminum paint (to be selected based on the service condition of component as per IS-13183). Two coats of paint shall be applied with total DFT 40 micron.</p> <p>c) Surface preparation before painting shall be carried out according to requirement indicated in this sub-section and international standard</p>	

CLAUSE NO.	<div style="text-align: right;"></div> TECHNICAL REQUIREMENTS		
1.06.10	<p>A) Specification for the application of Epoxy coating for internal protection of DM tank & other vessels/tanks (as applicable) shall be as follows:</p> <p>Primer : One coat of unmodified epoxy resin along with polyimide hardener.</p> <p>Paint : Two (2) coats unmodified epoxy resin along with Aromatic adduct hardener.</p> <p>Total thickness of primer and paint should not be less than 400 microns.</p> <p>B) Specification for application of chlorinated Rubber paint for external protection vessel, tanks, piping, valves & other equipments shall be as follows:</p> <p>i) For Indoor vessel, tanks, piping, valves & other equipments:</p> <p>(a) Surface preparation shall be done either manually or by any other approved method.</p> <p>(b) Primer coat shall consist of one coat of chlorinated rubber based zinc phosphate primer having minimum DFT of 50 microns.</p> <p>(c) Intermediate coat (or under coat) shall consist of one coat of chlorinated rubber based paint pigmented with Titanium dioxide with minimum DFT of 50 microns.</p> <p>(d) Top coat shall consist of one coat of chlorinated rubber paint of approved shade and colour with glossy finish and DFT of 50 microns.</p> <p>Total DFT of paint system shall not be less than 150 microns.</p> <p>ii) For Outdoor vessel, tanks, piping, valves & other equipments:</p> <p>(a) Surface preparation shall be blast cleared using non-siliceous abrasive after usual wire brushing, which shall conform to Sa 2-1/2 Swiss Standard.</p> <p>(b) Primer coat shall consist of one coat of epoxy resin based zinc phosphate primer having minimum DFT of 100 microns.</p> <p>(c) Intermediate coat (or under coat) shall consist of epoxy resin based paint pigmented with Titanium dioxide with minimum DFT of 100 microns.</p> <p>(d) Top coat shall consist of one coat of epoxy paint suitable pigmented of approved shade and colour with glossy finish and DFT of 75 microns. Additionally finishing coat of polyurethane of minimum DFT of 25 microns shall be provided.</p> <p>The paint may be applied in one coat, in case high built paint is used, otherwise two coats shall be applied.</p> <p>Total DFT shall not be less than 300 microns.</p>		




- ii) Painting specification for inside surfaces (such as inner surfaces of ducts/ tanks/ mills/ dampers/ ESP etc.) that are not covered specifically in above clauses, shall be provided with 2 coats of suitable primer i.e. PS5/ PS9 (Total DFT 60/40 micron) based on the temperature.


F) FGD System

- (i) Surface preparation shall be blast cleaned conforming to Sa 2-1/2 Swiss Standard.
- (ii) Primer coat shall consist of epoxy resin based zinc phosphate primer having minimum DFT of 100 microns.
- (iii) Intermediate coat (or under coat) shall consist of epoxy resin based paint pigmented with Titanium dioxide with minimum DFT of 100 microns.
- (iv) Top coat shall consist of one coat of epoxy paint suitable pigmented of approved shade and colour with glossy finish and DFT of 75 microns. Additionally finishing coat of polyurethane of minimum DFT of 25 microns shall be provided.

Note: 1) For PGMA's of Agitator and its sub-components shall be the same as that of similar items provided in the list. For Example, for motor, gear box, coupling etc. which are applicable for agitators PGMA-FW 212 & FW 701 are to be followed.


2) Painting : Painting details in the specification are minimum requirement. Painting shall be as per customer approved schedule to be submitted by successful bidder during detail engineering.


 BHEL, Ranipet - 632 406, India. Quality Assurance Department. Painting Scheme		BHEL DOC No: PS:KAHA:FGD:G213 Rev: 00 Dt: 16/11/2020 NTPC Contract No: CS-4200-109(4)-9-FC-NOA-6916 Dt: 30/03/2020 NTPC Doc No: 4200-109-RPT-PVM-H-021 Rev: 00 Dt: 16/11/2020							
Project		FGD Package of Kahalgaon STPS Stage I & II						BHEL Cust Nos: G213 G216 (4x210 MW) & G512 G514 (3x500 MW)	
Sl No	Surface Location	PGMA	Surface Preparation	Primer & Intermediate Coats		Finish Coat		Total DFT (µm min)	
				Paint	DFT (µm min)	Paint	DFT(µm min)		
29	Monorail for hoist & cranes; TRENCH COVER PLATE; MAN HOLE DOOR ROOF SHEETING (Clause 31.03.00 of Sec.VI, Part-B, Subsection- IV-D)	FW 709 FW 710 FW 717	Blast cleaning to Sa 2½ (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	Primer: One coat of Two component moisture curing zinc (ethyl) silicate primer coat (Min 80% metallic zinc content in dry film, solid by volume minimum 60% ±2). Zinc dust composition and properties shall be as per Type II as per ASTM D520-00 DFT- 70µ Intermediate: One coat of Two component polyamide cured epoxy with MIO content (containing lamellar MIO Min 30% on pigment, solid by volume min. 80%±2) DFT- 100µ	70 100	Finish: Two coats of two pack aliphatic isocyanate cured acrylic polyurethane paint to IS 13213 solid by volume min.55%±2) DFT- 35µ/ coat Shade: Grey white, RAL 9002 With gloss retention (SSPC paint spec no.36, ASTM D4587, D2244, D523 of level 2 after min. 1000 hrs exposure, gloss less than 30 and colour change less than 2.0Δ E)	70	240	
30	Handling Equipment- Hoists; AIR RECEIVERS; CHAIN PULLEYS (Clause 20.03.00 of Part- C Section VI)	FW 713 FW 714 FW 717 FW798	Power Tool Cleaning to st3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)-30µ/ coat Idler roller shall be applied with two coats of 70 microns at shop	60	Synthetic Enamel to IS 2932 Shade: Grey white RAL 9002 (Two coats)-20µ/ coat	40	100	
31	Agitator support; ABSORBER AGITATOR Clause 31.03.00 of Sec.VI, Part-B, Subsection- IV-D)	FW 721 FW 241	Blast cleaning to Sa 2½ (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	Primer: One coat of Two component moisture curing zinc (ethyl) silicate primer coat (Min 80% metallic zinc content in dry film, solid by volume minimum 60% ±2). Zinc dust composition and properties shall be as per Type II as per ASTM D520-00 DFT- 70µ	70	Finish: Two coats of two pack aliphatic isocyanate cured acrylic polyurethane paint to IS 13213 solid by volume min.55%±2) DFT- 35µ/ coat Shade: Grey white, RAL 9002	70	240	


 BHEL, Ranipet - 632 406, India. Quality Assurance Department. Painting Scheme		BHEL DOC No: PS:BHIL:FGD:G211 Rev: 04 Dt: 10/12/2020 NTPC Contract No: CC/CC&M-C-568-FC-NOA/141 Dt: 26/08/2019 NTPC Doc No: 9993-109-PVM-H-001 Rev: 04 Dt: 10/12/2020						
Project		FGD Package for NSPCL - BHILAI Expansion Power Project (2x250 MW) - BHEL Cust Nos: G211-G212						
SI No	Surface Location	PGMA	Surface Preparation	Primer & Intermediate Coats		Finish Coat		Total DFT (µm min)
				Paint	DFT (µm min)	Paint	DFT(µm min)	


2. FGD System

1 ○ △	Slurry recirculation pump System (Clause 7.05.00 of Section-VI, Part-B, Sub-Section-I-M5)	FW212	Power Tool Cleaning to St3 (SSPC-SP3)	Primer: Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats): DFT- 30µ / Coat	60	Two coats of Synthetic Enamel to IS 2932, DFT- 50µ/ coat Shade: Light blue RAL 5012	100	210
				Intermediate: One coat of Synthetic Enamel intermediate coat to IS 2932; DFT- 50µ	50			
2	Absorber System Internals – Structural items; Mist eliminator and accessories, Absorber baffle grating support, Mist eliminator support& Absorber Spray pipe support - Structural items (Clause 1.04.00 of Part- A Section VI)	FW213; FW215, FW216, FW217, FW218	Blast cleaning to Sa 2½	Primer: Two coats of Epoxy resin based Epoxy Zinc phosphate primer to IS 13238 DFT- 50µ/coat	100	Finish: One coat of Epoxy based finish paint with glossy finish to IS 14209; DFT- 75µ Finish: One coat of acrylic aliphatic polyurethane paint to IS 13213, DFT-25µ Shade: Grey White, RAL9002	75	300
				Intermediate: One coat of Two component epoxy based intermediate paint pigmented with Tio2, DFT- 100µ	100			
3	Absorber System- Base; Absorber system structures, Absorber shear plate, Duct supports, Structures for RC pump house& Hook up duct structure; Absorber system casing bottom#- Outside surfaces Absorber system casing top#- Outside surfaces. Emergency Quench water tank- Outside surfaces	FW219; FW220, FW231, FW232, FW233, FW234, FW236, FW238; FW221; FW222; FW226; FW301; FW302;	Blast cleaning to Sa 2½ (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	Primer: One coat of Two component moisture curing zinc (ethyl) silicate primer coat (Min 80% metallic zinc content in dry film, solid by volume minimum 60% ±2). Zinc dust composition and properties shall be as per Type II as per ASTM D520-00 DFT- 70µ	70	Finish: Two coats of two pack aliphatic isocyanate cured acrylic polyurethane paint to IS 13213 solid by volume min.55%±2) DFT- 35µ/ coat Shade: Grey white, RAL 9002 With gloss retention (SSPC paint spec no.36, ASTM D4587, D2244, D523 of level 2 after min. 1000 hrs exposure, gloss less than 30	70	240
Intermediate: One coat of Two component polyamide cured epoxy with MIO content (containing	100							


		BHEL, Ranipet - 632 406, India. Quality Assurance Department. Painting Scheme		BHEL DOC No. PS-BHIL-FGD-G211 Rev. 04 Dt. 10/12/2020 NTPC Contract No. CC/CC&M-C-568 FC-NOA/141 Dt. 26/08/2019 NTPC Doc No. 9993-109-PVM-H-001 Rev. 04 Dt. 10/12/2020				
Project		FGD Package for NSPCL - BHILAI Expansion Power Project (2x250 MW) - BHEL Cust Nos: G211-G212						
Sl No	Surface Location	PGMA	Surface Preparation	Primer & Intermediate Coats		Finish Coat		Total DFT (µm min)
				Paint	DFT (µm min)	Paint	DFT(µm min)	
	(# Inside surfaces are of C276 clad sheets. Hence, no paint is envisaged). (Clause 31.03.00 of Sec.VI, Part-B, Subsection- IV-D)	FW303		lamellar MIO Min 30% on pigment, solid by volume min. 80%±2) DFT- 100µ		and colour change less than 2.0Δ E)		
4 Δ	Absorber system accessories; Air oxidation system, Viewing ports (Without glass) (Clause 20.03.00 of Part- C Section VI)	FW223; FW230, FW239	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	Synthetic Enamel to IS 2932 Shade: Grey white RAL 9002 (Two coats)	40	100
5	Emergency Quench water tank- Inside surfaces (For temporary protection, until erection only)	FW226	Blast cleaning to Sa 2½ (Near white metal) with surface profile 35-50µm	Primer: Two coats of Red Oxide Zinc phosphate primer, DFT-30µ/coat; Total-60µ (Primer is only envisaged as lining is given in inside surfaces of the tank)				
6	Emergency quench system, Handling Equipment - RC Pump (Clause 20.03.00 of Part- C Section VI)	FW227, FW249	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	Synthetic Enamel to IS 2932 Shade: Grey white RAL 9002 (Two coats)	40	120
7	Absorber W/D interface, W/D wash system, Slurry distribution system, Oxidation Air distribution system (Clause 1.04.00 of Part- A Section VI)	FW228, FW229, FW243, FW244	Blast cleaning to Sa 2½	Primer: Two coats of Epoxy resin based Epoxy Zinc phosphate primer to IS 13238 DFT- 50µ/coat Intermediate: One coat of Two component epoxy based intermediate paint pigmented with Tio2 DFT- 100µ	100 100	Finish: One coat of Epoxy based finish paint with glossy finish to IS 14209; DFT- 75µ Finish: One coat of acrylic aliphatic polyurethane paint to IS 13213 DFT-25µ Shade: Grey White, RAL9002	75 25	300


 BHEL, Ranipet - 632 406, India. Quality Assurance Department. Painting Scheme		BHEL DOC No. PS.BHIL.FGD.G211 Rev. 04 Dt: 10/12/2020 NTPC Contract No. CC/CC&M-C-568-FC-NOA/141 Dt: 26/08/2019 NTPC Doc No. 9993-109-PVM-H-001 Rev: 04 Dt: 10/12/2020						
Project		FGD Package for NSPCL - BHILAI Expansion Power Project (2x250 MW) - BHEL Cust Nos. G211 G212						
Sl No	Surface Location	PGMA	Surface Preparation	Primer & Intermediate Coats		Finish Coat		Total DFT (µm min)
				Paint	DFT (µm min)	Paint	DFT(µm min)	
10	Foundation material for duct structures, Absorber, Elevator, RC pump shed, tanks, Silo Structure, pipe racks (Clause 20.04.00 of Part-C Section VI)	FW280, FW281, FW282, FW283, FW740, FW760, FW762, FW763	Temporary rust preventive fluid application as per PRQA 523 DFT- 20µ All Threaded and other surfaces of foundation bolt and its materials shall be coated with temporary rust preventive fluid. During execution of civil works the dried film of coating will be removed using Organic Solvents.					
11 ○	Elevator and accessories (Clause 20.03.00 of Part- C Section VI)	FW293, FW716	Power Tool Cleaning to st3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	Synthetic Enamel to IS 2932 Shade: Grey white RAL 9002 (Two coats)	60	120
12	Galleries and railings for Stairs, Absorber, Dampers, Ducts, Tanks (Clause 31.06.00 of Sec.VI, Part-B, Subsection- IV-D)	FW214, FW237, FW250, FW610, FW612, FW613, FW712, FW722	Blast cleaning to Sa 2½/ Acid pickling	Hand rails, Gratings- Hot dip galvanizing to 610gms/sq.m (minimum) as per IS: 4736 and to a coating thickness of 87µm (min).				
13	Galleries and railings for Stairs, Absorber, Dampers, Ducts, Tanks – Structures other than the above; Monorail for hoist & cranes; Agitator support; Limestone silo structures; Limestone Silo- Outside surfaces;	FW237, FW610, FW612, FW613, FW722; FW710; FW721; FW730; FW731	Blast cleaning to Sa 2½ (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	Primer: One coat of Two component moisture curing zinc (ethyl) silicate primer coat (Min 80% metallic zinc content in dry film, solid by volume minimum 60% ±2). Zinc dust composition and properties shall be as per Type II as per ASTM D520-00 DFT- 70µ	70	Finish: Two coats of two pack aliphatic isocyanate cured acrylic polyurethane paint to IS 13213 solid by volume min.55%±2) DFT- 35µ/ coat Shade: Grey white, RAL 9002 With gloss retention (SSPC paint spec no.36, ASTM D4587, D2244, D523 of level	70	240

 BHEL, Ranipet - 632 406, India. Quality Assurance Department. Painting Scheme		BHEL DOC No: PS:BHIL:FGD:G211 Rev: 04 Dt: 10/12/2020 NTPC Contract No: CC/CC&M-C-568-FC-NOA/141 Dt: 26/08/2019 NTPC Doc No: 9993-109-PVM-H-001 Rev: 04 Dt: 10/12/2020						
Project		FGD Package for NSPCL - BHILAI Expansion Power Project (2x250 MW) - BHEL Cust Nos: G211-G212						
Sl No	Surface Location	PGMA	Surface Preparation	Primer & Intermediate Coats		Finish Coat		Total DFT (µm min)
				Paint	DFT (µm min)	Paint	DFT(µm min)	
	(Clause 31.03.00 of Sec.VI, Part-B, Subsection- IV-D)			Intermediate: One coat of Two component polyamide cured epoxy with MIO content (containing lamellar MIO Min 30% on pigment, solid by volume min. 80%±2) DFT- 100µ	100	2 after min. 1000 hrs exposure, gloss less than 30 and colour change less than 2.0Δ E)		
14 ○ △	Slurry pumps & accessories, Water pumps (Clause 7.05.00 of Section-VI, Part-B, Sub-Section-I-M5)	FW701, FW702	Power Tool Cleaning to St3 (SSPC-SP3)	Primer: Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats) DFT- 30µ / Coat; Intermediate: One coat of Synthetic Enamel intermediate coat to IS 2932; DFT- 50µ	60 50	Two coats of Synthetic Enamel to IS 2932, DFT- 50µ/ coat Shade: Light blue RAL 5012	100	210
15 ○	Handling Equipment- Hoists& Man hole door (Clause 20.03.00 of Part- C Section VI)	FW713, FW714, FW717	Power Tool Cleaning to st3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats;DFT per coat-30micron) Idler roller shall be applied with two coats of 70 microns at shop	60 140	Synthetic Enamel to IS 2932 Shade: Grey white RAL 9002 (Two coats) --	60 --	120 140
16 ○	Limestone Silo- Inside surfaces (Conical portion) (For temporary protection, until erection only)	FW731	Blast cleaning to Sa 2½ (Near white metal) with surface profile 35-50µm conforming to ISO 8501-1	Primer: Two coats of Red Oxide Zinc phosphate primer to IS: 12744 (SS lining is inside the Limestone silo conical portion, hence primer is only envisaged; SS lining will be done at shops itself)	60	NIL	--	60
17 ○ △	Limestone Silo- Inside surfaces (Cylindrical portion) (For temporary protection, until erection only)	FW731	Blast cleaning to Sa 2½ (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	Primer Coat: One coat of two component moisture curing Inorganic Ethyl Zinc Silicate Primer to IS 14946, (Solid by volume- 60% (min)), (Metallic zinc content 80% (min)) DFT = 70 µm per coat (min.) Zinc dust composition shall be Type-II as per ASTM D520-00	70	--	--	70


		BHEL, Ranipet - 632 406, India. Quality Assurance Department. Painting Scheme		BHEL DOC No: PS:BHIL:FGD:G211 Rev. 04 Dt. 10/12/2020 NTPC Contract No: CC/CC&M-C-568-FC-NOA/141 Dt: 26/08/2019 NTPC Doc No: 9993-109-PVM-H-001 Rev. 04 Dt. 10/12/2020				
Project		FGD Package for NSPCL - BHILAI Expansion Power Project (2x250 MW) - BHEL Cust Nos: G211 - G212						
Sl No	Surface Location	PGMA	Surface Preparation	Primer & Intermediate Coats		Finish Coat		Total DFT (µm min)
				Paint	DFT (µm min)	Paint	DFT(µm min)	

21	Limestone Mill – Outside surfaces; Gypsum belt filter and accessories Structural items (Clause 1.04.00 of Part- A Section VI)	FW735; FW738	Blast cleaning to Sa 2½	Primer: Two coats of Epoxy resin based Epoxy Zinc phosphate primer to IS 13238 DFT- 50µ/coat Intermediate: One coat of Two component epoxy based intermediate paint pigmented with Tio2 DFT- 100µ	100 100	Finish: One coat of Epoxy based finish paint with glossy finish to IS 14209; DFT- 75µ Finish: One coat of acrylic aliphatic polyurethane paint to IS 13213 DFT-25µ Shade: Grey White, RAL9002	75 25	300
21 △	Limestone mill- Inside surfaces (For temporary protection, until erection only)	FW735	Blast cleaning to Sa 2½ (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	Primer Coat: One coat of two component moisture curing Inorganic Ethyl Zinc Silicate Primer to IS 14946, (Solid by volume- 60% (min)), (Metallic zinc content 80% (min)) DFT = 70 µm per coat (min.) Zinc dust composition shall be Type-II as per ASTM D520-00	70	--	--	70
23	Limestone slurry storage tank, Auxiliary absorber tank, Filtrate tank, Wastage water tank, Hydro cyclone waste water tank, Neutralization tank, Process Water tank, Belt filter washing tank, Primary hydro cyclone feed tank, Clarified water tank - Outside surfaces (Clause 31.03.00 of Sec.VI, Part-B, Subsection- IV-D)	FW742, FW743, FW744, FW745, FW747, FW748, FW785, FW786, FW800, FW802	Blast cleaning to Sa 2½ (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	Primer: One coat of Two component moisture curing zinc (ethyl) silicate primer coat (Min 80% metallic zinc content in dry film, solid by volume minimum 60% ±2). Zinc dust composition and properties shall be as per Type II as per ASTM D520-00 DFT- 70µ Intermediate: One coat of Two component polyamide cured epoxy with MIO content (containing	70 100	Finish: Two coats of two pack aliphatic isocyanate cured acrylic polyurethane paint to IS 13213 solid by volume min.55%±2) DFT- 35µ/ coat Shade: Grey white, RAL 9002 With gloss retention (SSPC paint spec no.36, ASTM D4587, D2244, D523 of level 2 after min. 1000 hrs exposure, gloss less than 30 and colour change less than 2.0Δ E)	70	240

 BHEL, Ranipet - 632 406, India. Quality Assurance Department. Painting Scheme		BHEL DOC No: PS:BHIL:FGD:G211 Rev: 04 Dt: 10/12/2020 NTPC Contract No: GC/GC&M-C-568 FC NOA/141 Dt: 26/08/2019 NTPC Doc No: 9993-109-PVM-H-001 Rev: 04 Dt: 10/12/2020						
Project		FGD Package for NSPCL - BHILAI Expansion Power Project (2x250 MW) - BHEL Cust Nos: G211-G212						
Sl No	Surface Location	PGMA	Surface Preparation	Primer & Intermediate Coats		Finish Coat		Total DFT (µm min)
				Paint	DFT (µm min)	Paint	DFT(µm min)	
				lamellar MIO Min 30% on pigment, solid by volume min. 80%±2) DFT- 100µ				
24	Limestone slurry storage tank, Auxiliary absorber tank, Filtrate tank, Wastage water tank, Hydrocyclone waste water tank, Neutralization tank, Process Water tank, Belt filter washing tank, Primary Hydrocyclone feed tank, Clarified water tank, Tank internal structure - Inside surfaces - (For temporary protection, until erection only)	FW742, FW743, FW744, FW745, FW747, FW748, FW749, FW800, FW802	Blast cleaning to Sa 2½ (Near white metal) with surface profile 35-50µm	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats) (Liner is inside the tank, hence primer is only envisaged; Protection till erection only)	60	NIL	--	60
25 △	Process water pipe accessories, Cooling pipe accessories; Slurry pipe accessories (Cl 2.17.00 of Sub Section-I-M7 of Part B of Section VI)	FW751, FW752; FW753	Power Tool Cleaning to St3 (SSPC-SP3)	Primer: Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats) DFT- 30µ / Coat; Intermediate: One coat of Synthetic Enamel intermediate coat to IS 2932; DFT- 30µ	60 30	Finish: Two coats of Synthetic Enamel to IS 2932, DFT- 35µ/ coat Shade: Grey white RAL 9002 Identification Tag: Sea Green Shade no: 217 as per IS 5	70	160
26 △	Service Air pipe accessories; Instrument air pipe accessories	FW754; FW755	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coat); DFT- 30µ / Coat	60	Synthetic Enamel to IS 2932 Shade: Grey white RAL 9002 (Two coats)- 35µ/ coat	70	160


		BHEL, Ranipet - 632 406, India. Quality Assurance Department. Painting Scheme		BHEL DOC No: PS:BHIL:FGD:G211 Rev: 04 Dt: 10/12/2020 NTPC Contract No: CC/CC&M-C-568-FC-NOA/141 Dt: 26/08/2019 NTPC Doc No: 9993-109-PVM-H-001 Rev: 04 Dt: 10/12/2020				
Project		FGD Package for NSPCL - BHILAI Expansion Power Project (2x250 MW) - BHEL Cust Nos: G211 G212						
SI No	Surface Location	PGMA	Surface Preparation	Primer & Intermediate Coats		Finish Coat		Total DFT (µm min)
				Paint	DFT (µm min)	Paint	DFT(µm min)	

	(CI 2.17.00 of Sub Section-I-M7 of Part B of Section VI)			Intermediate: One coat of Synthetic Enamel intermediate coat to IS 2932; DFT- 30µ	30	Identification Tag: Sky Blue Shade no: 101 as per IS 5		
27	All valves (Temp <95°C) (Clause 20.03.00 of Part- C Section VI)	FW815 to FW851	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	Synthetic Enamel to IS 2932 Shade: Grey white RAL 9002 (Two coats)- 30µ/ coat	60	120
28	Structure for Pipe racks, Trestle for pipe racks, Structures inside Gypsum dewatering building & Ball mill building (Clause 31.03.00 of Sec.VI, Part-B, Subsection- IV-D)	FW761, FW768, FW769, FW787	Blast cleaning to Sa 2½ (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	Primer: One coat of Two component moisture curing zinc (ethyl) silicate primer coat (Min 80% metallic zinc content in dry film, solid by volume minimum 60% ±2). Zinc dust composition and properties shall be as per Type II as per ASTM D520-00 DFT- 70µ Intermediate: One coat of Two component polyamide cured epoxy with MIO content (containing lamellar MIO Min 30% on pigment, solid by volume min. 80%±2) DFT- 100µ	70 100	Finish: Two coats of two pack aliphatic isocyanate cured acrylic polyurethane paint to IS 13213 solid by volume min.55%±2) DFT- 35µ/ coat Shade: Grey white, RAL 9002 With gloss retention (SSPC paint spec no.36, ASTM D4587, D2244, D523 of level 2 after min. 1000 hrs exposure, gloss less than 30 and colour change less than 2.0Δ E)	70	240
29	Supports for cable trays, Air receivers, commissioning& Mandatory spares, Tools & tackles (Clause 20.03.00 of Part- C Section VI)	FW779, FW798, FW988, FW996	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	Synthetic Enamel to IS 2932 Shade: Grey white RAL 9002 (Two coats)	40	100

		BHEL, Ranipet - 632 406, India. Quality Assurance Department. Painting Scheme		BHEL DOC No: PS:BHEL:FGD:G211 Rev: 04 Dt: 10/12/2020 NTPC Contract No: CC/CC&M-C-568-FC-NOA/141 Dt: 26/08/2019 NTPC Doc No: 9993-109-PVM-H-001 Rev: 04 Dt: 10/12/2020				
Project		FGD Package for NSPCL - BHILAI Expansion Power Project (2x250 MW) - BHEL Cust Nos: G211-G212						
Sl No	Surface Location	PGMA	Surface Preparation	Primer & Intermediate Coats		Finish Coat		Total DFT (µm min)
				Paint	DFT (µm min)	Paint	DFT(µm min)	

3. Gates & Dampers

01	Gates & Dampers > 95° C Insulated Surfaces & Uninsulated surfaces	57540, 57550, 57583	Power Tool Cleaning to St3 (SSPC-SP3)	HR Aluminium paint to IS 13183 Gr.II (upto 400 deg C)	40	--	--	40
02 ○	Seal air piping (CI 10.00.00 of Section-VI, Part-B, Sub-section: I-M3)	57141	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coat)	60	Synthetic Enamel to IS 2932 Shade: Grey white RAL 9002 (Two coats)- 30µ/ coat Identification Tag: Sky Blue Shade no: 101 (IS 5)	60	120
03	Blower with Motor, Knife Gate valve, Mandatory spares (CI 10.00.00 of Section-VI, Part-B, Sub-section: I-M3)	57491, 57497	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	Synthetic Enamel to IS 2932 Shade: Grey white RAL 9002 (Two coats)	40	100
04	Ladder, Cage for Ladder Toe Guard, Plate Floor Grill, Hand Rails, Hand Rail Post (Clause 31.06.00 of Sec.VI, Part-B, Subsection- IV-D)	57566	Blast cleaning to Sa 2½/ Acid Pickling	Hand rails, Gratings- Hot dip galvanizing to 610gms/sq.m (minimum) as per IS: 4736 and to a coating thickness of 87µm (min).				
05	Other Structural Items- Other than sl.no. 3 of above (Clause 31.03.00 of Sec.VI, Part-B, Subsection- IV-D)	57566	Blast cleaning to Sa 2½ (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1	Primer: One coat of Two component moisture curing zinc (ethyl) silicate primer coat (Min 80% metallic zinc content in dry film, solid by volume minimum 60% ±2). Zinc dust composition and properties shall be as per Type II as per ASTM D520-00 DFT- 70µ	70	Finish: Two coats of two pack aliphatic isocyanate cured acrylic polyurethane paint to IS 13213 solid by volume min.55%±2) DFT- 35µ/ coat Shade: Grey white, RAL 9002 With gloss retention (SSPC paint spec no.36, ASTM	70	240

		BHEL, Ranipet - 632 406, India. Quality Assurance Department. Painting Scheme		BHEL DOC No: PS:BHIL:FGD:G211 Rev: 04 Dt: 10/12/2020 NTPC Contract No: CC/CC&M C 568-FC-NOA/141 Dt: 26/08/2019 NTPC Doc No: 9993-109-PVM-H-001 Rev: 04 Dt: 10/12/2020				
Project		FGD Package for NSPCL - BHILAI Expansion Power Project (2x250 MW) - BHEL Cust Nos: G211-G212						
SI No	Surface Location	PGMA	Surface Preparation	Primer & Intermediate Coats		Finish Coat		Total DFT (µm min)
				Paint	DFT (µm min)	Paint	DFT(µm min)	
				Intermediate: One coat of Two component polyamide cured epoxy with MIO content (containing lamellar MIO Min 30% on pigment, solid by volume min. 80%±2) DFT- 100µ	100	D4587, D2244, D523 of level 2 after min. 1000 hrs exposure, gloss less than 30 and colour change less than 2.0Δ E)		


Painting specification for Material Handling portion/equipment

SI No	Surface Location	PGMA:	Surface Preparation	Primer, Intermediate & Finish
1	Painting specification for Material Handling portion/equipment will be	FW249;FW310;FW710;FW714;FW713.	same as main equipment specified separately in this document.	same as main equipment specified separately in this document.

4. Painting of Damaged Areas


For areas where paint has deteriorated badly by erosion and areas where the paint film has lost its adhesion property and where the steel has got rusted appreciably: These areas are to be repainted as per the following procedure:

SI No	Surface Location	Surface Preparation	Primer, Intermediate & Finish
1	Paint damaged Components falling under SI Nos: 04,05 of Fans; SI Nos: 02, 03, 07, 09, 13, 20, 21, 23, 28 of FGD and SI no: 5 of GAD.	Hand/ Power Tool cleaning to Bare metal to minimum 6 inches peripheral area adjoining to damaged area	Primer: Zinc rich epoxy to IS 14589 or suitable primer with existing paint scheme, DFT-70µ (If Metal surface exposed) followed by intermediate & finish coat as per respective schemes. If primer is intact- Intermediate & finish as per respective schemes.
2	Paint damaged components failing under other SI Nos of Fans, FGD & GAD	Power Tool Cleaning to Bare metal	Primer and Finish: As given in respective scheme

	BHEL, Ranipet - 632 406, India. Quality Assurance Department. Painting Scheme			BHEL DOC No: PS:BHIL:FGD:G211 Rev: 04 Dt: 10/12/2020 NTPC Contract No: CC/CC&M-C-568-FC-NOA/141 Dt: 26/08/2019 NTPC Doc No: 9993-109-PVM-H-001 Rev: 04 Dt: 10/12/2020				
	Project FGD Package for NSPCL - BHILAI Expansion Power Project (2x250 MW) BHEL Cust Nos: G211 G212							
Sl No	Surface Location	PGMA	Surface Preparation	Primer & Intermediate Coats		Finish Coat		Total DFT (µm min)
				Paint	DFT (µm min)	Paint	DFT(µm min)	


General Notes:

- No painting is required for Galvanized, non-ferrous & stainless steel items, except as indicated above.
- Machined items are to be applied with coat of temporary rust preventive oil.
- PGMAs covered in sub-supplier (ie., Purchased) items viz., Agitator / slide bearing and other sub-delivery components etc., are not indicated in the above list. However, the Painting Schedule for all items supplied by all sub-suppliers and BOI under the scope of BHEL shall be same as for main equipment covered in this document.
- In sub-assy, wherever plates / sheets of thickness less than or equal to 5mm and rods are used, very minor items like clamps, small items etc.- Power Tool or Hand Tool Cleaning to SSPC - SP 3 / SP 2 shall be followed and painting under Sl no:01 of Fans shall be followed.
- Ground shade/colour of finish paints and identification tag/band for equipment, fans, piping, pipe services, supporting structures and other components is followed as per NTPC doc no: QS-01-DIV-W-4 at site.
- All components covered under different PGMAs are to be painted. In case any component is left out, the same shall deemed to be included under the relevant section.
- All threaded and other surfaces of foundation bolts and its materials, insulation pins, Anchor channels, Sleeves shall be coated with temporary rust preventive fluid and during execution of civil works; the dried film of coating shall be removed using organic solvents.
- Painting requirement for all electrical equipment shall be as per the details identified in specification for the respective equipment.
- All steel structures shall be provided with painting as given in the specification. Further, painting system shall also meet the requirements of corrosivity category C3 (durability high) as per ISO 12944.
- Finish coat to be applied after an interval of min 10 hrs and within 6 months (after completion of intermediate coat).
- Primer coat on steel shall be applied in shop immediately after blast cleaning by airless spray technique.
- For the portion of steel surfaces embedded in concrete, the surface shall be prepared by Manual cleaning and provided with Primer coat of Chlorinated Rubber based Zinc Phosphate Primer of Minimum 50 Micron DFT.

		BHEL, Ranipet - 632 406, India. Quality Assurance Department. Painting Scheme		BHEL DOC No: PS:BHIL:FGD:G211 Rev: 04 Dt: 10/12/2020 NTPC Contract No: CC/CC&M-C 568-FC-NOA/141 Dt: 26/08/2019 NTPC Doc No: 9993-109-PVM-H-001 Rev: 04 Dt: 10/12/2020				
Project		FGD Package for NSPCL - BHILAI Expansion Power Project (2x250 MW) - BHEL Cust Nos: G211-G212						
SI No	Surface Location	PGMA	Surface Preparation	Primer & Intermediate Coats		Finish Coat		Total DFT (µm min)
				Paint	DFT (µm min)	Paint	DFT (µm min)	


Painting Scheme - Details of Procurement & Application Processes

SI No	Type of Paint	Specification of Paint	No of Packs	Volume of Solids (% Min)	Mode of Application	Min. Over Coating Interval (Hours)	Shade
01	Epoxy Zinc phosphate primer	IS 13238	2	40	Spray	24	Grey
02	Zinc Ethyl silicate primer (% Zn on dry film= 80 (min))	IS 14946	2	60	Airless Spray only At Shop	24	Grey
03	Epoxy High solid-Polyamide cured Epoxy based MIO pigmented intermediate coat	--	2	80	Airless Spray only At Shop	16	Brown
04	Aliphatic isocyanate acrylic polyurethane paint	IS 13213	2	55	Spray At Shop	16	Windows Grey RAL 7040
05	Heat resistant aluminum paint	IS 13183 Grade II	1	--	Brush/ Spray	24	--
06	Long oil alkyd Synthetic enamel finish paint	IS 2932	1	35	Brush/ Spray	12	Corresponding shade no
07	Synthetic Enamel Intermediate coat	IS 2932	1	40	Brush/ Spray	12	--
08	Red oxide Zinc phosphate primer	IS 12744	1	--	Brush/ spray	12	--


	BHEL, Ranipet - 632 406, India. Quality Assurance Department. Painting Scheme		BHEL DOC No: PS:BHIL:FGD:G211 Rev: 04 Dt: 10/12/2020 NTPC Contract No: CC/CC&M-C-568-FC-NOA/141 Dt: 26/08/2019 NTPC Doc No: 9993-109-PVM-H-001 Rev: 04 Dt: 10/12/2020					
	Project FGD Package for NSPCL BHILAI Expansion Power Project (2x250 MW) BHEL Cust Nos: G211-G212							
SI No	Surface Location	PGMA	Surface Preparation	Primer & Intermediate Coats		Finish Coat		Total DFT (µm min)
				Paint	DFT (µm min)	Paint	DFT(µm min)	

PGMA Description & Product Details

SI No	PGMA	PGMA Description	Product /Items Details
01	FW212	Slurry recirculation pump system	RC Pumps incl Shaft seal, Common Base Plate, Coupling and Guard, Gear Box, Expansion Bellow, Anchor Bolts & Fasteners, Special Tools
02	FW219	Absorber system base	Absorber tank bottom plate
03	FW220	Absorber system structures	Absorber tank structure, Absorber tower structure, Spray headers structure
04	FW221	Absorber system casing bottom	Absorber tank wall casing- bottom
05	FW222	Absorber system casing top	Absorber Tank wall casing –Top, Mist Eliminator supports, Spray pipe supports, Internal Beam, Shim plates in Absorber area, Internal Struts
06	FW223	Absorber system accessories	Nozzles and flanges, Inspection doors & Man holes, Viewing ports, Antifoam dosing equipment, Suction strainers- FRP
07	FW226	Emergency Quench water tank	Base Plate & its supports, Roof, Shell
08	FW227	Emergency Quench System	Emergency Quenching Spray Pipe, Nozzle for Emergency Pipe, Fasteners, Gaskets
09	FW230	Air oxidation System	Oxidation Blowers, Common Base Plate, Coupling and Guard, Anchor Bolts & Fasteners, Expansion Bellow, Special Tools, Suction & Discharge Silencers, Acoustic Enclosure, Water Injection cooling system, Pipe, Valves & Instruments
10	FW239	Viewing Ports	Viewing Ports
11	FW244	Oxidation air distribution System	Pipe & Fittings, Flanges, Pipe Hanger, Bottom Elbow, Bottom sliding supports
12	FW249	Handling Equip- RC Pump	Handling Equip- RC Pump
13	FW251	Expansion joint between bypass	Expansion joints, Seal Plates & Fasteners
14	FW252	Expansion joint between scrubbers	Fabric & its fixing fasteners, Sleeves & Flanges, Gaskets
15	FW255	Ducts between bypass duct inlet & booster fan	Plates & Stiffeners, Guide Vanes
16	FW256	Ducts between Booster fan & Absorber	Plates & Stiffeners, Guide Vanes
17	FW257	Ducts between Absorber & stack	Plates & Stiffeners, Guide Vanes
18	FW260	Duct structure between bypass duct& Booster fan	Duct Supports, Gusset Plate, Divider plate, Internal Struts, Support bearings
19	FW261 FW262	Duct structure between booster fan& absorber & Absorber and Stack	Duct Supports, Gusset Plate, Divider plate, Internal Struts, Support bearings
20	FW292	Structures for Elevator	Columns, Seal Plate, Bracings, Enclosure (Purlin& sheeting)

 BHEL, Ranipet - 632 406, India. Quality Assurance Department. Painting Scheme		BHEL DOC No: PS:BHIL:FGD:G211 Rev: 04 Dt: 10/12/2020 NTPC Contract No: CC/CC&M-C-568-FC-NOA/141 Dt: 26/08/2019 NTPC Doc No: 9993-109-PVM-H-001 Rev: 04 Dt: 10/12/2020						
Project		FGD Package for NSPCL - BHILAI Expansion Power Project (2x250 MW) - BHEL Cust Nos: G211 - G212						
SI No	Surface Location	PGMA	Surface Preparation	Primer & Intermediate Coats		Finish Coat		Total DFT (µm min)
				Paint	DFT (µm min)	Paint	DFT (µm min)	

SI No	PGMA	PGMA Description	Product /Items Details
21	FW293	Elevator and accessories	Base Frame, Buffer Spring, Mast Section, Cage, Control Panel & AC, Mandatory Spares
22	FW310	Structures for booster fan handling	Columns, Beams, Bracings, Seal plate
23	FW610 FW722	Galleries & railings for Scrubbers, Tank	Stairs, Handrail, Step treads, Floor grills, Ladders, Foundation bolts, Fasteners
24	FW701	Slurry pumps & accessories	Slurry Pumps incl Shaft seal, Common Base Plate, Coupling and Guard, Belt & Pulley, Expansion Bellow, Anchor Bolts & Fasteners, Motor & accessories, Sump Pumps incl Shaft seal, Common Base Plate, Coupling and Guard, Belt & Pulley, Anchor Bolts & Fasteners, Motor & accessories
25	FW710	Monorail for hoist& cranes	Insert Plate, Stiffener plate, Monorail beam
26	FW721	Agitator support	Channels & Beams
27	FW730	Limestone silo structures	Columns, Beams, Bracings, Seal plate, Angles, channels
28	FW731	Limestone silo	Base plate & its supports, Shell, Roof
29	FW723 FW724 FW725	Air cannon Bag filter Nozzles & flanges	Bag filter, Air cannon bin activator, Nozzles & Flanges
30	FW733	Limestone silo approach platforms	Stairs, Handrail, Step treads, Floor grills, Ladders, Foundation bolts, Fasteners
31	FW734	Limestone mill	Wet ball mill, Hydro cyclone- Mill area, Mill circuit pump, Mill separator tank with Agitator
32	FW742	Lime stone slurry storage tank	Base plate & its supports, Shell, Roof
33	FW743	Auxiliary Absorber tank	Base plate & its supports, Shell, Roof
34	FW744	Filtrate tank	Base plate & its supports, Shell, Roof
35	FW745	Wastage water tank	Base plate & its supports, Shell, Roof
36	FW747	Hydro cyclone waste water tank	Base plate & its supports, Shell, Roof
37	FW748 FW785 FW786	Process Water tank Belt filter washing tank Primary Hydro cyclone feed tank	Base plate & its supports, Shell, Roof
38	FW751 FW752	Process water pipe accessories Cooling water pipe accessories	CS/FRP Pipes & Fittings, Sight Glass, R Orifice, Gaskets & Fasteners
39	FW753	Slurry pipe accessories	CSRL/FRP Pipes & Fittings, Strainer (Cone), Expansion Joint-Rubber, R Orifice, Gaskets & Fasteners

		BHEL, Ranipet - 632 406, India. Quality Assurance Department. Painting Scheme		BHEL DOC No: PS:BHIL:FGD:G211 Rev: 04 Dt: 10/12/2020 NTPC Contract No: CC/CC&M-C-568-FC-NOA/141 Dt: 26/08/2019 NTPC Doc No: 9993-109-PVM-H-001 Rev: 04 Dt: 10/12/2020				
		Project FGD Package for NSPCL BHILAI Expansion Power Project (2x250 MW) BHEL Cust Nos: G211-G212						
SI No	Surface Location	PGMA	Surface Preparation	Primer & Intermediate Coats		Finish Coat		Total DFT (µm min)
				Paint	DFT (µm min)	Paint	DFT(µm min)	

SI No	PGMA	PGMA Description	Product /Items Details
40	FW754	Service air pipe accessories	GI Pipes & Fittings, Flexible Hose, Expansion Joint (Metallic), Hose connector, R Orifice, Gaskets & Fasteners
41	FW755	Instrument air pipe accessories	SS Pipes & Fittings, Strainer(Y Type), Gaskets & Fasteners
42	FW815 to FW851	Valves and fittings	Globe valves, Ball Valves, Butterfly Valves, Diaphragm Valves, Gate Valves, Check Valves, Pinch Valves, Knife Gate Valves, Control Valves, Relief Valves
43	FW761	Structures for Pipe racks	Bracings, Columns
44	FW280 FW281 FW282 FW283 FW740 FW760 FW763	Foundation material for duct structure Foundation material for absorber Foundation material for Tanks Foundation material for Pipe racks Foundation material for Elevator Foundation material for RC pump shed	Foundation bolts Template
45	FW766 FW767	Platforms for Pipe rack Platforms for Sub-Pipe rack	Stairs, Handrail, Step treads, Floor grills, Ladders, Foundation bolts, Fasteners
46	FW768 FW769	Trestle for Main & sub Pipe racks	Truss, Beams, Supports for all Pipes
47	FW779	Supports for cable tray	Double Sup Channel & Base plates, Single Sup Channel & Base plates Cantilever Arm, Fasteners & clamps, Brackets
48	FW996	Tools	Erection , commissioning, special tools
49	FW798	Air receivers	Instrument Air receivers, Any Instruments/Valves
50	FW800	Clarified water tank	Base plate & its supports, Shell, Roof
51	FW802	Neutralization tank & accessories	Base plate & its supports, Shell, Roof
52	FW988 FW997 FW999	Commissioning spares & Mandatory spares	Startup & commissioning spares, Mandatory spares

1172900/2022/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-C3

REV. 00

Date: NOV 2022

**SECTION-I,
 Sub Section-C3**

ELECTRICAL SPECIFICATION


**2X500 MW NTPC SIPAT TPS, STAGE-II
(FGD PACKAGE)**

**TECHNICAL SPECIFICATION
AGITATORS OF FGD SLURRY TANKS
(ELECTRICAL PORTION)**



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, UP [INDIA]**

1172900/2022/PS-PEM-MAX

	TITLE:	SPECIFICATION NO.
	ELECTRICAL EQUIPMENT SPECIFICATION	
	FOR	VOLUME NO. : II-B
	AGITATORS OF FGD SLURRY TANKS	SECTION: I
	2X500 MW NTPC SIPAT TPS STAGE-II (FGD PACKAGE)	REV NO. : 00 DATE: 28.04.2022
	SHEET: 1 OF 1	

CONTENTS

SECTION	TITLE	NO OF SHEETS
I	SPECIFIC TECHNICAL REQUIREMENTS	3
I	ELECTRICAL SCOPE BETWEEN BHEL & VENDOR (ANNEURE-I)	1
I	ELECTRICAL LOAD DATA FORMAT (ANNEXURE-II)	1
I	CABLE SCHEDULE FORMAT (ANNEXURE-III)	1
I	TECHNICAL SPECIFICATION FOR MOTORS	10
I	MOTOR DATASHEET-A	1
I	MOTOR DATASHEET-C	5
II	STANDARD SPECIFICATION FOR LV MOTORS	5
II	REFERENCE QUALITY PLAN (BHEL + NTPC)	14

The requirements mentioned in Section-I shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section-II.

1172900/2022/PS-PEM-MAX



**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
AGITATORS OF FGD SLURRY TANKS**

2X500 MW NTPC SIPAT TPS, STAGE-II (FGD PACKAGE)

SPECIFICATION NO.

VOLUME NO. : **II-B**SECTION : **I**REV NO. : **00** DATE : 28.04.2022

SHEET : 1 OF 3

TECHNICAL SPECIFICATION

FOR

AGITATORS OF FGD SLURRY TANKS

(ELECTRICAL PORTION)



**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
AGITATORS OF FGD SLURRY TANKS**

2X500 MW NTPC SIPAT TPS, STAGE-II (FGD PACKAGE)

SPECIFICATION NO.
VOLUME NO. : II-B
SECTION : I
REV NO. : 00 DATE : 28.04.2022
SHEET : 2 OF 3

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Electrical load requirement for AGITATORS OF FGD SLURRY TANKS (all AC & DC loads at different voltage levels like 415V AC, 240 V AC, 220 V DC etc).
- e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL
- g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
- h) Motor shall meet minimum requirement of motor specification.
- i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- j) Cable BOQ worked out based on routing of cable listing provided by the vendor for “ both end equipment in vendor’s scope”shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:

Refer “Electrical Scope between BHEL and Vendor”.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

- 3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate.
- 3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

1172900/2022/PS-PEM-MAX



**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
AGITATORS OF FGD SLURRY TANKS**

2X500 MW NTPC SIPAT TPS, STAGE-II (FGD PACKAGE)

SPECIFICATION NO.

VOLUME NO. : **II-B**SECTION : **I**REV NO. : **00** DATE : 28.04.2022

SHEET : 3 OF 3

4.0 List of enclosures :

- a) Electrical scope between BHEL & vendor (Annexure –I)
- b) Technical specification for motors.
- c) Datasheets & quality plan for motors.
- d) Electrical Load data format (Annexure –II)
- e) BHEL cable listing format (Annexure –III)

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE: AGITATORS OF FGD SLURRY TANKS (Supply Package)

PROJECT: 2X500 MW SIPAT TPS STAGE-II (FGD PACKAGE)

<u>S.NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1	415 V MCC	BHEL	BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motors.
3	Power cables, control cables and screened control cables	BHEL	BHEL	Incoming cable from BHEL supplied MCC will be informed by BHEL. Screened control cable between DCS & field equipment will also be informed by BHEL. Vendor shall provide lugs & glands accordingly.
4	Cable trays, accessories & cable trays supporting system	BHEL	BHEL	
5	Cable glands and lugs for equipments supplied by Vendor	Vendor	BHEL	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power and control cables.
6	Conduit and conduit accessories for cabling between equipments supplied by vendor	BHEL	BHEL	
7	Equipment grounding & lightning protection	BHEL	BHEL	
8	Below grade grounding	BHEL	BHEL	
9	LT Motors with base plate and foundation hardware	Vendor	BHEL	Makes shall be subject to BHEL approval at contract stage.
10	Mandatory spares	Vendor	-	Vendor to quote as per specification.
11	Recommended O & M spares	Vendor	-	As per specification
12	Any other equipment/material/service required for completeness of system but not specified above (to ensure trouble free and efficient operation of the system).	Vendor	BHEL	
13	Electrical equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

1. Make of all electrical equipments/items supplied shall be reputed make & shall be subject to approval of BHEL after award of contract.
2. All QPs shall be subject to approval of BHEL after award of contract without any commercial implication.





SUB-SECTION-II-E2


MOTORS


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


TECHNICAL SPECIFICATION
SECTION-VI
BID DOCUMENT NO.: CS-0011-109(6)-9


CLAUSE NO.	TECHNICAL REQUIREMENTS																												
	<p style="text-align: center;">MOTORS</p> <p>1.00.00 GENERAL REQUIREMENTS</p> <p>1.01.00 For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment.</p> <p>1.02.00 All equipment's shall be suitable for rated frequency of 50 Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.</p> <p>1.03.00 Contactor shall provide fully compatible electrical system, equipment's, accessories and services.</p> <p>1.04.00 All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.</p> <p>1.05.00 Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.</p> <p>1.06.00 The responsibility of coordination with electrical agencies and obtaining all necessary clearances for Contactors equipment and systems shall be under the Contactor scope.</p> <p>1.07.00 Degree of Protection</p> <p>Degree of protection for various enclosures as per IEC60034-05 shall be as follows :-</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">i) Indoor motors</td> <td style="width: 10%; text-align: center;">-</td> <td style="width: 40%;">IP 54</td> </tr> <tr> <td>ii) Outdoor motors</td> <td style="text-align: center;">-</td> <td>IP 55</td> </tr> <tr> <td>iii) Cable box-indoor area</td> <td style="text-align: center;">-</td> <td>IP 54</td> </tr> <tr> <td>iv) Cable box-Outdoor area</td> <td style="text-align: center;">-</td> <td>IP 55</td> </tr> </table> <p>2.00.00 CODES AND STANDARDS</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">1) Three phase induction motors</td> <td style="width: 10%; text-align: center;">:</td> <td style="width: 40%;">IS/IEC:60034</td> </tr> <tr> <td>2) Single phase AC motors</td> <td style="text-align: center;">:</td> <td>IS/ IEC:60034</td> </tr> <tr> <td>3) Crane duty motors</td> <td style="text-align: center;">:</td> <td>IS:3177, IS/IEC:60034</td> </tr> <tr> <td>4) DC motors/generators</td> <td style="text-align: center;">:</td> <td>IS:4722, IS/IEC:60034</td> </tr> <tr> <td>5) Energy Efficient motors</td> <td style="text-align: center;">:</td> <td>IS 12615, IEC:60034-30</td> </tr> </table>	i) Indoor motors	-	IP 54	ii) Outdoor motors	-	IP 55	iii) Cable box-indoor area	-	IP 54	iv) Cable box-Outdoor area	-	IP 55	1) Three phase induction motors	:	IS/IEC:60034	2) Single phase AC motors	:	IS/ IEC:60034	3) Crane duty motors	:	IS:3177, IS/IEC:60034	4) DC motors/generators	:	IS:4722, IS/IEC:60034	5) Energy Efficient motors	:	IS 12615, IEC:60034-30	
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LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(6)-9	SUB SECTION-II-E2 MOTORS	PAGE 1 OF 9																										


CLAUSE NO.	TECHNICAL REQUIREMENTS		
3.00.00	TYPE		
3.01.00	AC Motors: <ol style="list-style-type: none"> a) Squirrel cage induction motor suitable for direct-on-line starting. b) Continuous duty LT motors upto 200 KW Output rating (at 50 deg.C ambient temperature), shall be Premium Efficiency class-IE3, conforming to IS 12615, or IEC:60034-30. HT motors shall have minimum design efficiency of 95 %. However, tolerance on this efficiency value shall be applicable as per IEC 60034 c) Crane duty motors shall be slip ring/ squirrel cage Induction motor as per the requirement. d) Motor operating through variable frequency drives shall be suitable for inverter duty with VPI insulation. Also these motors shall comply the requirements stipulated in IEC: 60034-18-41 and IEC: 60034-18-42 as applicable. e) Motors operating through variable frequency drives shall also meet the requirements mentioned in subsection for VFD. 		
3.02.00	DC Motors	Shunt wound.	
4.00.00	RATING	<ol style="list-style-type: none"> (a) Continuously rated (S1). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor. (b) Whenever the basis for motor or driven equipment ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations. 	
5.00.00	TEMPERATURE RISE Air cooled motors 70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation. Water cooled 80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation.		
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(6)-9	SUB SECTION-II-E2 MOTORS	PAGE 2 OF 9


CLAUSE NO.	TECHNICAL REQUIREMENTS		
6.00.00	OPERATIONAL REQUIREMENTS		
6.01.00	Starting Time		
6.01.01	For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.		
6.01.02	For motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than starting time.		
6.01.03	For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.		
6.01.04	Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.		
6.02.00	Torque Requirements		
6.02.01	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor rated torque.		
6.02.02	Pull out torque at rated voltage shall not be less than 205% of rated torque. It shall be 275% for crane duty motors.		
6.03.00	Starting voltage requirement <ul style="list-style-type: none"> (a) Up to 85% of rated voltage for ratings below 110 KW (b) Up to 80% of rated voltage for ratings from 110 KW to 200 KW (c) Up to 85% of rated voltage for ratings from 201 KW to 1000 KW (d) Up to 80% of rated voltage for ratings from 1001 KW to 4000 KW (e) Up to 75 % of rated voltage for ratings above 4000KW 		
7.00.00	DESIGN AND CONSTRUCTIONAL FEATURES		
7.01.00	Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided. However for flame proof motors, space heater terminals inside the main terminal box may be acceptable.		
7.02.00	All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). The method of movement of primary and secondary coolant shall be self-circulated by fan or pump directly mounted on the rotor of the main motor as per		
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(6)-9	SUB SECTION-II-E2 MOTORS	PAGE 3 OF 9

CLAUSE NO.	TECHNICAL REQUIREMENTS		
7.03.00	<p>IEC 60034-6. However VFD driven motors can be offered with forced cooling type with machine mounted fan or pump driven by separate electric motor. Motors and EPB located in hazardous areas shall have flame proof enclosures conforming to IS:2148 as detailed below</p> <p>(a) Fuel oil area : Group – IIB</p> <p>(b) Hydrogen generation : Group - IIC or (Group-I, Div-II as per plant area NEC) or (Class-1, Group-B, Div-II as per NEMA /IEC60034)</p> <p>Winding and Insulation</p> <p>(a) Type : Non-hygroscopic, oil resistant, flame resistant</p> <p>(b) Starting duty : Two hot starts in succession, with motor initially at normal running temperature.</p> <p>(c) 11kV, 6.6 KV & 3.3 kV AC motors : Thermal class 155 (F) insulation. The winding insulation process shall be total Vacuum Pressure Impregnated i.e resin poor method. The lightning Impulse & interturn insulation surge withstand level shall be as per IEC-60034 part-15.</p> <p>(d) 240VAC, 415V AC & 220V DC motors : Thermal Class (B) or better</p>		
7.04.00	Motors rated above 1000KW shall have insulated bearings/housing to prevent flow of shaft currents.		
7.05.00	Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.		
7.06.00	Noise level for all the motors shall be limited to 85 dB(A) except for BFP motor for which the maximum limit shall be 90dB(A). Vibration shall be limited within the limits prescribed in IS:12075 / IEC 60034-14 . Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.		
7.07.00	In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer and minimum 2 numbers duplex platinum resistance type temperature detectors.		
7.08.00	Motor body shall have two earthing points on opposite sides.		
7.09.00	11 KV motors shall be offered with Separable Insulated Connector (SIC) as per IEEE 386. The offered SIC terminations shall be provided with protective cover and trifurcating sleeves. SIC termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.		
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(6)-9	SUB SECTION-II-E2 MOTORS	PAGE 4 OF 9

CLAUSE NO.	TECHNICAL REQUIREMENTS		
7.10.00	3.3/6.6 KV motors shall be offered with dust tight phase separated double walled (metallic as well as insulated barrier) Terminal box. Contractor shall provide termination kit for the offered Terminal box. The offered Terminal Box shall be suitable for fault level of 250 MVA for 0.12 sec. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) shall be provided.		
7.11.00	The spacing between gland plate & centre of bottom terminal stud shall be as per Table-I.		
7.12.00	All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.		
7.13.00	The motors shall be suitable for bus transfer schemes provided on the 11kV, 6.6 KV, 3.3 kV /415V systems without any injurious effect on its life.		
7.14.00	For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.		
7.15.00	The size and number of cables (for HT motors) to be intimated to the successful Contactor during detailed engineering and the Contactor shall provide terminal box suitable for the same.		
8.00.00	The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance): (a) From 50KW & upto 110KW : 11.0 (b) From 110 KW & upto 200 KW : 9.0 (c) Above 200 KW & upto 1000KW : 10.0 (d) From 1001KW & upto 4000KW : 9.0 (e) Above 4000KW : 6 to 6.5		
10.00.00	TYPE TEST		
10.01.00	HT MOTORS		
10.01.01	The Contactor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The Contactor shall indicate the charges for each of these type tests separately in the relevant schedule of Section - VII- (BPS) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the Employer's engineer.		
10.01.02	The type tests shall be carried out in presence of the Employer's representative, for which minimum 15 days notice shall be given by the Contactor. The Contactor shall obtain the Employer's approval for the type test procedure before conducting		
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(6)-9	SUB SECTION-II-E2 MOTORS	PAGE 5 OF 9

CLAUSE NO.	TECHNICAL REQUIREMENTS			
10.01.03	<p>the type test. The type test procedure shall clearly specify the test set-up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.</p> <p>In case the Contactor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering the type test reports to the Employer for waiver of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The Employer reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the Contactor.</p>			
10.01.04	<p>Further the Contactor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED" and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the Contactor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the Contactor shall conduct all such tests under this contract at no additional cost to the Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval.</p>			
10.01.05	<p>LIST OF TYPE TESTS TO BE CONDUCTED</p> <p>The following type tests shall be conducted on each type and rating of HT motor</p> <ul style="list-style-type: none"> (a) No load saturation and loss curves upto approximately 115% of rated voltage (b) Measurement of noise at no load. (c) Momentary excess torque test (subject to test bed constraint). (d) Full load test(subject to test bed constraint) (e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp.,coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose. 			
<p align="center">LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(6)-9</p>	<p align="center">SUB SECTION-II-E2 MOTORS</p>	<p align="center">PAGE 6 OF 9</p>	

CLAUSE NO.	TECHNICAL REQUIREMENTS		
10.01.06	<p>LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED</p> <p>The following type test reports shall be submitted for each type and rating of HT motor</p> <ul style="list-style-type: none"> (a) Degree of protection test for the enclosure followed by IR, HV and no load run test. (b) Terminal box-fault level withstand test for each type of terminal box of HT motors only. (c) Lightning Impulse withstand test on the sample coil shall be as per clause no. 4.3 IEC-60034, part-15 (d) Surge-withstand test on inter-turn insulation shall be as per clause no. 4.2 of IEC 60034, part-15 		
10.02.00	<p>LT Motors</p>		
10.02.01	<p>LT Motors supplied shall be of type tested design. During detailed engineering, the Contactor shall submit for Employer's approval the reports of all the type tests as listed in this specification and carried out within last <i>ten</i> years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.</p>		
10.02.02	<p>However if the Contactor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the Contactor shall conduct all such tests under this contract at no additional cost to the Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval.</p>		
10.02.03	<p>LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED</p> <p>The following type test reports shall be submitted for each type and rating of LT motor of above 100 KW only</p> <ul style="list-style-type: none"> 1. Measurement of resistance of windings of stator and wound rotor. 2. No load test at rated voltage to determine input current power and speed 3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors) 4. Full load test to determine efficiency power factor and slip 5. Temperature rise test 		
<p>LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(6)-9</p>	<p>SUB SECTION-II-E2 MOTORS</p>	<p>PAGE 7 OF 9</p>

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	<p>6. Momentary excess torque test.</p> <p>7. High voltage test</p> <p>8. Test for vibration severity of motor.</p> <p>9. Test for noise levels of motor(Shall be limited as per clause no 7.06.00 of this section)</p> <p>10. Test for degree of protection and</p> <p>11. Overspeed test.</p> <p>12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1</p>		
10.03.00	All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.		
10.04.00	The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and “No design Change”. Minor changes if any shall be highlighted on the endorsement sheet.		
LOT-6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(6)-9	SUB SECTION-II-E2 MOTORS	PAGE 8 OF 9

TECHNICAL REQUIREMENTS



TABLE - I

DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS


Motor MCR in KW	Minimum distance between centre of bottom terminal stud and gland plate in mm
UP to 3 KW	As per manufacturer's practice.
Above 3 KW - upto 7 KW	85
Above 7 KW - upto 13 KW	115
Above 13 KW - upto 24 KW	167
Above 24 KW - upto 37 KW	196
Above 37 KW - upto 55 KW	249
Above 55 KW - upto 90 KW	277
Above 90 KW - upto 125 KW	331
Above 125 KW-upto 200 KW	385/203 (For Single core cables only)


For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm.

PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:

NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:

Motor MCR in KW	Clearance
UP to 110 KW	10mm
Above 110 KW and upto 150 KW	12.5mm
Above 150 KW	19mm

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	<p>correspond to the terminal numbering in wiring diagrams. All metal parts shall be of non-ferrous material. In case of screw type terminals the screw shall be captive, preferably with screw locking design. All terminal blocks shall be suitable for terminating on each side the required cables/wire size. All internal wiring shall be of cu. Conductor PVC wire.</p>		
3.05.00	<p>Terminations & Straight Through Joints</p>		
3.05.01	<p>Termination and jointing kits for 33kV, 11 kV, 6.6 KV and 3.3 kV grade XLPE insulated cables shall be of proven design and make which have already been extensively used and type tested. Termination kits and jointing kits shall be Pre-moulded type or heat shrinkable type. Further Cold shrinkable type termination and jointing kits are also acceptable. The Cold shrinkable type kits shall be type tested as per relevant standards. Calculation to withstand the required fault level shall also be furnished in case of cold shrinkable type kits. 33 kV, 11 kV, 6.6 KV and 3.3kV grade joints and terminations shall be type tested and Type test reports as per IS:13573 Part-II and IEC60502 shall be furnished. Also, heat shrink material shall comply with requirements of ESI 09-13 (external tests). Critical components used in cable accessories shall be of tested and proven quality as per relevant product specification/ESI specification. Cable joints and terminations should be with FRLS properties as per IEC 60754-1&2. Kit contents shall be supplied from the same source as were used for type testing. The kit shall be complete with the tinned copper solderless crimping type cable lugs & ferrule or mechanical connectors (wherein bolts are tightened that shear off at an appropriate torque) as per DIN standard suitable for aluminium compacted conductor cables. (Tender drg. no 0000-211-POE –A-51-RA of cable lug attached at the end of this chapter).</p>		
3.05.02	<p>Straight through joint and termination shall be capable of withstanding the fault level of 21 KA for 0.12 Sec. with dynamic peak of 52 KA for 33 KV system & of 40 kA for 0.12 sec with a dynamic peak of 100 kA for 11 kV, 6.6 KV & 3.3 KV system. Straight through joints shall have provisions for shield connection and earthing wherever required and complete with all accessories and consumables suitable for storage without deterioration at a temperature of 50 deg. C with shelf life of more than five years. 1.1 kV grade straight through joints shall also be of proven design</p>		
3.05.03	<p>1.1 KV grade Straight Through Joint shall be of proven design.</p>		
3.06.00	<p>Cable glands</p>		
3.06.01	<p>Cable shall be terminated using double compression type cable glands. Testing requirements of Cable glands shall conform to BS:6121 and gland shall be of robust construction capable of clamping cable and cable armour (for armoured cables) firmly without injury to insulation. Cable glands shall be made of heavy duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall also be made of brass with nickel chrome plating Rubber components shall be of neoprene or better synthetic material and of tested quality. Cable glands shall be suitable for the sizes of cable supplied/erected.</p>		
<p>LOT-6 PROJECTS FLUE GAS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(6)-9</p>	<p>SUB SECTION-II-E6 CABLING, EARTHING & LIGHTNING PROTECTION</p>	<p>Page 7 of 27</p>

CLAUSE NO.	TECHNICAL REQUIREMENTS		
3.07.00	<p>Cable lugs/ferrules</p>		
3.07.01	<p>Cable lugs/ferrules shall be solderless crimping type suitable for power and control cables as per the DIN 46239. Aluminium solderless crimping lugs/ ferrules shall be used for Aluminium cables and Copper lugs/ferrules shall be used for Copper cables. Bimetallic washers or bimetallic type lugs shall be used for bimetallic connections.</p> <p>Crimping tool for crimping (from 1.5sqmm cable to 630sqmm cables) above mentioned lugs shall be of Hexagonal Type crimp profile, with suitable die of crimp match code.</p> <p>Characteristics of crimping tool:</p> <ol style="list-style-type: none"> 1) To should generate enough pressure to pass pull out test as per IEC 61238-1. Relevant type test to be produced for the sizes specified in the tender. 2) Tool die shall be replaceable for assorted sizes and crimp code to be mentioned on both part the die. 3) Tool should be compliant of testing according to IEC, UL and GS standards. <p>Tool shall have features such as:</p> <ul style="list-style-type: none"> • Auto retraction system • Manual retraction stop. • Feedback signals for improper pressure • Better battery capacity and with status display • Flexible and rotating head for easy crimping. 		
3.08.00	<p>Trefoil clamps</p>		
3.08.01	<p>Trefoil clamps for single core cables shall be pressure die cast aluminum or fibre glass or nylon and shall include necessary fixing accessories like G.I. nuts, bolts, washers, etc. Trefoil clamps shall have adequate mechanical strength, when installed at 1 mtr intervals, to withstand the forces generated by the peak value of maximum system short circuit current.</p>		
3.09.00	<p>Cable Clamps & Ties</p>		
3.09.01	<p>The cable clamps/ties required to clamp multicore cables shall be of SS-316 material, 12mm wide, polyster coated ladder lock type. The clamps/ties shall have self locking arrangement & shall have sufficient strength. The cable clamps/ties shall be supplied in finished individual pieces of suitable length to meet the site requirements.</p>		
3.10.00	<p>Receptacles</p>		
3.10.01	<p>Receptacles boxes shall be fabricated out of MS sheet of 2mm thickness and hot dipped gavanised or of die-cast aluminium alloy of thickness not less than 2.5 mm. The boxes shall be provided with two nos. earthing terminals, gasket to achieve IP55 degree of protection, terminal blocks for loop-in loop-out for cable of specified sizes, mounting brackets suitable for surface mounting on wall/column/structure, gland plate etc. The ON-OFF switch shall be rotary type heavy duty, double</p>		
<p>LOT-6 PROJECTS FLUE GAS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(6)-9</p>	<p>SUB SECTION-II-E6 CABLING, EARTHING & LIGHTNING PROTECTION</p>	<p>Page 8 of 27</p>



LV MOTORS

DATA SHEET-A

2X500 MW NTPC SIPAT STAGE-II
(FGD PACKAGE)

SPECIFICATION NO.

VOLUME

II B

SECTION

D

REV. NO.

DATE: 28.04.2022

SHEET 1


OF 2


ANNEXURE-III


- 1.0 Design ambient temperature : 50° C
- 2.0 Maximum acceptable kW rating of LV motor : 200KW *
- 3.0 Installation (Indoors/ Outdoors) : As required
- 4.0 Details of supply system
- a) Rated voltage (with variation) : 415V ± 10%
- b) Rated frequency (with variation) : 50 Hz + 3 % to - 5%
- c) Combined voltage & freq. variation : 10% (sum of absolute values)
- d) System fault level at rated voltage : 50 kA for 1 sec
- e) Short time rating for terminal boxes
- o 110 kW and above (Breaker : 50 KA for 0.25 sec.
Controlled)
- o Below 110 kW (Contactor : 50 KA protected by HRC fuse
Controlled)
- f) LV System grounding : Solidly
- 5.0 Winding & Insulation : Class F with temp rise limited to class B
- 6.0 Minimum voltage for starting : 85% for motor ratings below 110kW
(As percentage of rated voltage) 80% for motor ratings from 110kW to 200kW.
- 7.0 Power cables data : Shall be given during detailed engg.
- 8.0 Earth Conductor Size & Material : Shall be given during detailed engg.
- 9.0 Space heater supply (for motors >=30kw) : 240 V, 1φ, 50 Hz
- 10.0 Rating up to which Single phase motor : Acceptable below 0.2 kW
- 11.0 Locked rotor current
- a) Limit as percentage of FLC : As per IS 12615
- 12.0 Makes : BHEL/ Customer approval (Package owner to take care)
- 13.0 Paint shade : Blue (RAL 5012) – Corrosion proof
- 14.0 Degree Of protection for motor/ terminal box : Degree of protection for various enclosures as per IEC60034-05 shall be as follows:-
- i) Indoor motors - IP 54
- ii) Outdoor motors - IP 55
- iii) Cable box-indoor area - IP 54
- iv) Cable Box-Outdoor area - IP 55


* **LT motors of continuous duty shall be Premium Efficiency class-IE3 conforming to IS-12615**


15.0 TESTING REQUIREMENTS: IN LINE WITH SPECIFICATION

CLAUSE NO.	Bidder's Name			
	DE-1B	LT MOTORS		
	A.	GENERAL		
	5.	Manufacturer & Country of origin. (Shall be as per approved QA make)		
	6.	Equipment driven by motor		
	7.	Motor type		
	8.	Quantity		
	B.	DESIGN AND PERFORMANCE DATA		
	18.	Frame size		
	19.	Type of duty		
	20.	Type of enclosure /Method of cooling/ Degree of		
	21.	Applicable standard to which motor generally		
	22.	Efficiency class as per IS 12615		
	23.	(a)Whether motor is flame proof	Yes/No	
		(b)If yes, the gas group to which it conforms as per IS:2148		
	24.	Type of mounting		
	25.	Direction of rotation as viewed from DE END		
	26.	Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)		
	27.	Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)		
	28.	Maximum continuous load demand of driven		
	29.	Rated Voltage (volts)		
	30.	Permissible variation of :		
		a. Voltage (Volts)		
		b. Frequency (Hz)		
		c. Combined voltage and frequency		
	31.	Rated speed at rated voltage and		
	32.	At rated Voltage and frequency:		
		a. Full load current		
	LOT 6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		ATTACHMENT-12 TO SECTION-VII TECHNICAL DATA SHEETS BID DOC. NO.: CS-0011-109(6)-9	PART-F CHAPTER-II MODULE-II SUB-SECTION:DE1 MOTORS
			PAGE 13 OF 17	


CLAUSE NO.	Bidder's Name		
	b. No load current		
33.	Power Factor at		
	a. 100% load		
	b. NO load		
	c. Starting.		
34.	Efficiency at rated voltage and frequency,		
	a. 100% load		
	b. 75% load		
	c. 50% load		
35.	Starting current (amps) at		
	a. 100 % voltage		
	b. 85% voltage		
	c. 80% voltage		
36.	Minimum permissible starting Voltage (Volts)		
37.	Starting time with minimum permissible voltage		
	a. Without driven equipment coupled		
	b. With driven equipment coupled		
38.	Safe stall time with 100% and 110% of rated		
	a. From hot condition		
	b. From cold condition		
39.	Torques :		
	a. Starting torque at min. permissible voltage(kg-		
	b. Pull up torque at rated voltage.		
	c. Pull out torque		
	d. Min accelerating torque (kg.m) available		
	e. Rated torque (kg.m)		
40.	Stator winding resistance per phase (ohms at 20		
41.	GD ² value of motors		
LOT 6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	ATTACHMENT-12 TO SECTION-VII TECHNICAL DATA SHEETS BID DOC. NO.: CS-0011-109(6)-9	PART-F CHAPTER-II MODULE-II SUB-SECTION:DE1 MOTORS	PAGE 14 OF 17

CLAUSE NO.	Bidder's Name		
42.	No of permissible successive starts when motor is in hot condition		
43.	Locked Rotor KVA Input		
44.	Locked Rotor KVA/KW		
45.	Vibration limit :Velocity (mm/s)		
46.	Noise level limit (dBA)		
C.	CONSTRUCTIONAL FEATURES		
1.	Stator winding insulation		
	a. Class & Type		
	b. Winding Insulation Process		
	c. Tropicalised (Yes/No)		
	d. Temperature rise over specified maximum ambient temperature of 50 deg C		
	e. Method of temperature measurement		
	f. Stator winding connection		
2.	Main Terminal Box		
	a. Type		
	b. Location(viewed from NDE side)		
	c. Entry of cables(bottom/side)		
	d. Recommended cable size(To be matched with cable size envisaged by owner)		
	e. Fault level (MVA),Fault level duration(sec)		
	f. Cable glands & lugs details (shall be suitable for		
3.	Type of DE/NDE Bearing		
4.	Motor Paint shade		
5.	Weight of		
	a. Motor stator (KG)		
	b. Motor Rotor (KG)		
	c. Total weight (KG)		
LOT 6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		ATTACHMENT-12 TO SECTION-VII TECHNICAL DATA SHEETS BID DOC. NO.: CS-0011-109(6)-9	PART-F CHAPTER-II MODULE-II SUB-SECTION:DE1 MOTORS
			PAGE 15 OF 17

CLAUSE NO.	Bidder's Name			
	D. List of accessories.			
	1. Space Heaters (Applicable for 30 KW & above motor) (Nos./Power in watts/supply voltage)			
	2. Terminal Box for Space Heater (Yes/No)			
	3. Speed switch (Yes/No)			
	4. Insulation of bearing (Yes/No)			
	5. Noise reducer(Yes/No)			
	6. Grounding pads			
		i) No and size on motor body		
		ii) Nos on terminal Box		
	7. Vibration pads			
		i) Nos and size		
		ii) Location		
	8. Any other fitments			
	E. List of curves.			
	1. Torque speed characteristic of the motor			
	2. Thermal withstand characteristic			
	3. Starting. current Vs. Time			
	4. Starting. current Vs speed			
	5. P.F. and Effi. Vs Load			
	F. Additional Data to be filled for each rating of DC Motor			
	1. Rated armature voltage (Volt)			
	2. Rated field excitation (Amp)			
	3. Permissible % variation in voltage			
	4. Minimum Permissible Starting voltage (volt)			
	5. At rated voltage			
		i) Full load Armature current.(Amp)		
	LOT 6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	ATTACHMENT-12 TO SECTION-VII TECHNICAL DATA SHEETS BID DOC. NO.: CS-0011-109(6)-9	PART-F CHAPTER-II MODULE-II SUB-SECTION:DE1 MOTORS	PAGE 16 OF 17

CLAUSE NO.	Bidder's Name		
		ii) Full load Field current (Amp)	
		iii) No load Armature current (Amp)	
6.		Full load Field current (Amp)	
7.		No load Armature current (Amp)	
8.		Minimum permissible field current (Amp) to avoid	
		i) Maximum permissible voltage	
		ii) Rated voltage	
		iii) Minimum Permissible Voltage	
9.		Resistance (indicative Values) in ohm	
		i) Armature winding (Arm + IP + Series) at 25	
		ii) Field Winding at 25 deg. C	
10..		Inductance (indicative values)	
		i) Armature winding	
		ii) Field winding	
11		Value of trimmer resistance (ohm) to be connected in series with the shunt field to	
		i) 220 V DC	
		ii) 250 V DC	
		iii) 187 V DC	
12		Value of the external resistance (ohm) required to be connected in series with armature during starting only	
13		Technical data sheet for external resistance box	
14		GA drawing of motor	
15		Starting time calculation	
16		Starter resistance design calculation	
17		Electrical connection diagram of motor	
LOT 6 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	ATTACHMENT-12 TO SECTION-VII TECHNICAL DATA SHEETS BID DOC. NO.: CS-0011-109(6)-9	PART-F CHAPTER-II MODULE-II SUB-SECTION: DE1 MOTORS	PAGE 17 OF 17


1172900/2022/PS-PEM-MAX

	MOTORS	SPECIFICATION NO.
	DATA SHEET – C	VOLUME II B
	2X500 MW SIPAT STAGE-II (FGD PACKAGE)	SECTION D
		REV NO. 00 DATE 28.04.2022
		SHEET 1 OF 2

S. No.	Description	Data to be filled by successful bidder
A.	General	
1	Manufacturer & country of origin	
2	Motor type	
3	Type of starting	
4	Name of the equipment driven by motor & Quantity	
5	Maximum Power requirement of driven equipment	
6	Rated speed of Driven Equipment	
7	Design ambient temperature	
B.	Design and Performance Data	
1	Frame size & type designation	
2	Type of duty	
3	Rated Voltage	
4	Permissible variation for	
5	a) Voltage	
6	b) Frequency	
7	c) Combined voltage & frequency	
8	Rated output at design ambient temp (by resistance method)	
9	Synchronous speed & Rated slip	
10	Minimum permissible starting voltage	
11	Starting time in sec with mechanism coupled	
12	a) At rated voltage	
13	b) At min starting voltage	
14	Locked rotor current as percentage of FLC (including IS tolerance)	
15	Torque	
	a) Starting	
	b) Maximum	
16	Permissible temp rise at rated output over ambient temp & method	
17	Noise level at 1.0 m (dB)	
18	Amplitude of vibration	
19	Efficiency & P.F. at rated voltage & frequency	
	a) At 100% load	
	c) At 75% load	

NAME OF VENDOR			SEAL	REV.
NAME	SIGNATURE	DATE		

1172900/2022/PS-PEM-MAX

	MOTORS	SPECIFICATION NO.
	DATA SHEET – C	VOLUME II B
	2X500 MW SIPAT STAGE-II (FGD PACKAGE)	SECTION D
		REV NO. 00 DATE 28.04.2022
		SHEET 2 OF 2

S. No.	Description	Data to be filled by successful bidder
	c) At starting	
C.	Constructional Features	
1	Method of connection of motor driven equipment	
2	Applicable Standard	
3	DOP of Enclosure	
4	Method of cooling	
5	Class of insulation	
6	Main terminal box	
	a) Type	
	b) Power Cable details (Conductor, size, armour/unarmour)	
	c) Cable Gland & lugs details (Size, type & material)	
	d) Permissible Fault level (kArms & duration in sec)	
7	Space heater details (Voltage & watts)	
8	Flame proof motor details (if applicable)	
	a) Enclosure	
	b) suitability for hazardous area	
	i Zone	O / I / II
	ii Group	IIA / IIB / IIC
9	No. of Stator winding	
10	Winding connection	
11	Kind of rotor winding	
12	Kind of bearings	
13	Direction of rotation when viewed from NDE	
14	Paint Shade & type	
15	Net weight of motor	
16	Outline mounting drawing No (To be enclosed as annexure)	
D.	Characteristic curves/ drawings (To be enclosed for motors of rating $\geq 55KW$)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			



GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO.
PE-SS-999-506-E101

VOLUME NO. : **II-B**

SECTION : **D**

REV NO. : **00** DATE : 29/08/2005


SHEET : 1 OF 1

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO.: PE-SS-999-506-E101 Rev 00

	GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 29/08/2005 SHEET : 1 OF 4
1.0 INTENT OF SPECIFICATION		
<p>The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer's work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station.</p> <p>Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.</p>		
2.0 CODES AND STANDARDS		
<p>Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards:</p>		
IS:325 IS : 900 IS: 996 IS: 4722 IS: 4691 IS: 4728 IS: 1231 IS: 8789 IS: 13555	Three phase Induction motors Code of practice for installation and maintenance of induction motors Single phase small AC and universal motors Rotating Electrical machines Degree of Protection provided by enclosures for rotating electrical machines Terminal marking and direction of rotation rotating electrical machines Dimensions of three phase foot mounted induction motors Values of performance characteristics for three phase induction motors Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment	
IS: 2148 IS: 5571 IS: 12824 IS: 12802 IS: 12065 IS: 12075	Flame proof enclosures for electrical appliance Guide for selection of electrical equipment for hazardous areas Type of duty and classes of rating assigned Temperature rise measurement for rotating electrical machines Permissible limits of noise level for rotating electrical machines Mechanical vibration of rotating electrical machines	
<p>In case of imported motors, motors as per IEC-34 shall also be acceptable.</p>		
3.0 DESIGN REQUIREMENTS		
3.1	Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A	
3.2	Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above.	
3.3 Starting Requirements		
3.3.1	Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.	
3.3.2	Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.	



GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO.
PE-SS-999-506-E101

VOLUME NO. : **II-B**

SECTION : **D**

REV NO. : **00** DATE : 29/08/2005

SHEET : 2 OF 4

The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.

3.3.3 The following frequency of starts shall apply

- i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.
- ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour)
- iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor

3.4 Running Requirements

3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.

3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.

3.5 Stress During bus Transfer

3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.

3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.

3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.

3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.


4.0 CONSTRUCTIONAL FEATURES


4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy

4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.

Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled

4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.

	GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 29/08/2005
		SHEET : 3 OF 4
4.4.	Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.	
4.5	Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.	
4.6	In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation. In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.	
4.7	Terminals and Terminal Boxes	
4.7.1	Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A. Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".	
4.7.2	unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.	
4.7.3	Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W & V respectively.	
4.7.4	Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.	
4.7.5	Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.	
4.7.6	Degree of protection for terminal boxes shall be IP 55 as per IS 4691.	
4.7.7	Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.	
4.7.8.	Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.	
4.7.9	Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.	
4.8	Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.	
4.9	General	

	GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 29/08/2005
		SHEET : 4 OF 4
<p>4.9.1 Motors provided for similar drives shall be interchangeable.</p> <p>4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.</p> <p>4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.</p> <p>4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.</p> <p>4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.</p> <p>4.9.6 Name plate with all particulars as per IS: 325 shall be provided</p> <p>4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.</p> <p>5.0 INSPECTION AND TESTING</p> <p>5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.</p> <p>5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.</p> <p>5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.</p> <p>5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.</p> <p>6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT</p> <p>a) OGA drawing showing the position of terminal boxes, earthing connections etc.</p> <p>b) Arrangement drawing of terminal boxes.</p> <p>c) Characteristic curves: <i>(To be given for motor above 55 kW unless otherwise specified in Data Sheet).</i></p> <p>i) Current vs. time at rated voltage and minimum starting voltage.</p> <p>ii) Speed vs. time at rated voltage and minimum starting voltage.</p> <p>iii) Torque vs. speed at rated voltage and minimum voltage. For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.</p> <p>iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.</p>		