CLAUSE NO.	QUALITY ASSURANCE
	(b.) Longitudinal butt weld on bellow shall be subjected to suitable NDT examination before forming, and after forming MPE / DP test shall be carried out. (c.) All welds shall be subjected to 100% magnetic particle/dye pentrant check and butt welds shall be subjected to 100% radiographic testing. (d.) All the bellows subjected to vacuum service shall be subjected to vacuum test. (e.) The bellows shall be subjected to movement test to establish suitability to perform satisfactorily in site conditions. During this test spring rate shall also be measured. (f.) The testing of MEJ shall be as per Expansion joint Manufacturer Association (EJMA) standard.

QUALITY ASSURANCE

Items / Components \ 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
10. Atmospheric Storage Tanks/ Pressure Vessels	Y[a]	Y	Y[b]	Y	Y	Y[8]	Y		Y[c]	Y[7]	
11. Rubber lining	Y[a]				Y				Y	Y[9]	
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]	
13. Hoists & Cranes	Y[a]	Y	Y[b]	Y	Y	Y[8]		Y	Y		
14. Agitators /Flash Mixer/ Flocculator	Y[a]	Y	Y[b]	Y	Y			Y		Y[10]	
15. Pipes (Fabricated)	Y[a]	Y	Y	Y	Y	Y	Y		Y		
16. Ventilation/Exhaust Fan	Y[a]		Y[b]	Y	Y			Y[11]	Y	Y[dc]	

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.

Y[7] 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.

Y[8] RT as per fabrication code requirements. However, dished ends welds, if manufactured by using welded plates shall be subjected to 100% RT.

Y[9] 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.

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.

Y[11] One Fan of each type & size shall be routine performance tested as per corresponding code fir 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.

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.

Agitator inspection requirement-Please note that attached QP is indicative only. Stage inspection and Quantum of check may vary during final approval by customer (NTPC).

Ranipet	MANUFACTURER'S NAME AND ADDRESS M/S BHEL: BAP: RANIPET 632 406 TAMIL NADU	STANDARD QUALITY PLAN ITEM: AGITATOR SYSTEM: FGD	QP NO	FGS: 720
			REV. NO:	00
			DATE:	12.02.2019
			PAGE NO:	Page 2 of 2

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	B					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D *	** 10.			11.
														Horizontal
4.2	Free Air Run Test of complete assembly	Measurement Current, RPM, Noise & Vibration	MA	Measurement	100%	10%	Vendor Standard / Approved Drawing / Data Sheet		IR	√	P	W	W	
4.3	Review of QA Documents	Verification of QA Documents	MA	Verification	100%	100%	As per Appd. MQP		IR		P	V	V	
5.0	**Painting & Preservation**													
5.1		Painting Material	MI	Review of MTC	100%		Appd. "Painting Procedure"/Approved Painting Schedule		IR	√	P	V	-	
5.2		Surface treatment and inspection	MI	Visual	100%	-	-do-		IR	√	P	-	-	
5.3		DFT Check	MI	Measurement	10%		-do-		IR	√	P	V	-	
5.4		Painting Surface Quality	MI	Visual	100%		-do-		IR	√	P	V	-	
6.0	**Inspection before Delivery**													
6.1	Packing	Size, appearance & firmness	MI	Measurement & Visual	100%		As per "Packing Procedure"		IR	√	P	V	-	
6.2	Deliver Documents	Markings, Packing List & Details Packing List, etc., Check	MI	Verification	100%		As per "Packing Procedure"		IR	√	P	V	-	

NOTES:

1. For Agitator Motor rating is 45KW and motor make NTPC/BHEL Approved source.
2. Routine test report duly witnessed by main contractor as per applicable standard shall be reviewed during inspection (more than 30 KW Rating).

LEGEND: * RECORD, IDENTIFIED WITH "TICK" (√) UNDER COLUMN 'D' SHALL BE SUBMITTED TO CUSTOMER AS A QA DOCUMENTATION PACKAGE. **M:** MANUFACTURER / SUB SUPPLIER, **C:** MAIN CONTRACTOR. **N:** CUSTOMER/CONSULTANT **P:** PERFORM **W:** WITNESS **V:** REVIEW OF RECORDS **MA:** MAJOR AND **MI:** MINOR	**PREPARED BY** Rakesh Kumar Madhu,(SEr/QA)	**REVIEWD & APPROVED BY** K C Gandhi Parimalam,(DGM/QA)

Ranipet	MANUFACTURER'S NAME AND ADDRESS M/S BHEL: BAP: RANIPET 632 406 TAMIL NADU	STANDARD QUALITY PLAN ITEM: AGITATOR SYSTEM: FGD	QP NO	FGS: 720
			REV. NO:	00
			DATE:	12.02.2019
			PAGE NO:	Page 1 of 2

SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	B					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D *	** 10.			11.
1.0	**Raw Material Inspection**													
1.1	All materials including casting & forgings	Chem. & Mech. Dimensions Surface Defects	MA MA MA	Review of MTC Measurement Visual	1/Heat 100% 100%	1/Heat - -	As per spec. & Appd. Dwg		TC IR IR	√	P P P	V - -	V - -	
2.0	**Motor : Review Of Manufacture Test Certificate**													
3.0	**In Process Inspection**													
3.1	Welding Qualifications	WPS & PQR	MA	WPS, PQR & WPQ	100%		ASME Sec IX		IR	√	P	V	V	Recent qualified WPS, PQR and WPQ shall be submitted for review during inspection
3.2	Marking, Cutting, Edge Preparation Tacking	Dimensions	MA	Measurement	100%	-	Appd.Dwg.		IR		P	-	-	
3.3	Welds	Dimensions & Surface Quality	MA	Measurement	100%		Appd.Dwg.& ASME Sec VIII		IR	√	P	W	V	
3.4	Machining of Components	Dimensions Surface Defects	MA	Measurement Visual	100% 100%	- -	Appd. Dwg.		IR		P P	- -	- -	
3.5	Impeller	Static balance test	MA	Measurement	100%		As per Specs.		TR	√	P	V	V	
3.6	Rubber Lining	Hardness test & Spark test	MA	Measurement	100%		As per Specs.	Appd. Drg	TR	√	P	W	V	
3.7	Assembly	Dimensions Completeness	MA	Measurement Visual	100% 100%		Appd.Drg.		IR	√	P P	V V	V V	
4.0	**Final Inspection**													
4.1	Final Assembly	Overall Dimensions & Completeness	MA MA	Measurement Visual	100%	10%	Appd. Dwg		IR	√	P	W	V	*10% pf each type (Vertical /

LEGEND: * RECORD, IDENTIFIED WITH "TICK" (√) UNDER COLUMN 'D' SHALL BE SUBMITTED TO CUSTOMER AS A QA DOCUMENTATION PACKAGE.
M: MANUFACTURER / SUB SUPPLIER, **C:** MAIN CONTRACTOR.
N: CUSTOMER/CONSULTANT **P:** PERFORM **W:** WITNESS **V:** REVIEW OF RECORDS
MA: MAJOR AND **MI:** MINOR

PREPARED BY	REVIEWD & APPROVED BY
Rakesh Kumar Madhu,(SEr/QA)	K C Gandhi Parimalam,(DGM/QA)

QUALITY REQUIREMENT

(a) Since this items comes under Sub-QR Category, hence inspection at vendor works is applicable by BHEL/BHEL TPI and NTPC as per NTPC Approved Quality plan.

(b) Supplier shall submit the MQP in NTPC Format (Sample QP attached herewith) for approval of NTPC. Please note that attached QP is indicative and minimum requirement only. Stage inspection and Quantum of check may vary during final approval by customer (NTPC).

(c) Painting : Painting details in the specification are minimum requirement. Painting shall be as per approved schedule which will be submitted by successful bidder during detail engg.

(d) In case of order placed on foreign vendors, vendor has to finalize Inspection agency at their own cost and carry out inspection as per the approved Quality plan . Further, the list of third party insection agencies (as applicable) shall be provided by BHEL during detail engineering.Vendor has to furnish BHEL the inspection reports and other documents required as per approved Quality plan duly signed by the Inspection Agency after their witness for BHEL's review and acceptance.

CLAUSE NO.	QUALITY ASSURANCE

MOTOR

TESTS/CHECKS / TEMS/COMPONENTS	Visual	Dimensional	Make/Type/Rating /General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment	Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	Routine & Acceptance tests as per IS-325/IS-4722 /IS- 9283/IS 2148/IEC60034\IEC 60079-I/ IS-12615	Vibration	Over speed	Tan delta, shaft voltage & polarization index test	Paint shade, thickness & adhesion
Plates for stator frame, end shield, spider etc.	Y	Y	Y	Y	Y				Y										
Shaft	Y	Y	Y	Y	Y	Y			Y										
Magnetic Material	Y	Y	Y	Y			Y			Y		Y							
Rotor Copper/Aluminium	Y	Y	Y	Y			Y		Y										
Stator copper	Y	Y	Y	Y			Y		Y			Y							
SC Ring	Y	Y	Y	Y	Y		Y	Y	Y										
Insulating Material	Y		Y	Y			Y					Y							
Tubes, for Cooler	Y	Y	Y	Y	Y				Y		Y								
Sleeve Bearing	Y	Y	Y	Y	Y				Y		Y								
Stator/Rotor, Exciter Coils	Y	Y	Y				Y	Y											
Castings, stator frame, terminal box and bearing housing etc.	Y	Y	Y	Y	Y			Y											
Fabrication & machining of stator, rotor, terminal box	Y	Y			Y			Y	Y										

CLAUSE NO.	QUALITY ASSURANCE

Wound stator	Y	Y					Y	Y											
Wound Exciter	Y	Y					Y	Y											
Rotor complete	Y	Y					Y						Y	Y					
Exciter, Stator, Rotor, Terminal Box assembly	Y	Y					Y												
Accessories, RTD, BTD,CT, Space heater, antifriction bearing, gaskets etc.	Y	Y	Y																
Complete Motor	Y	Y	Y												Y	Y	Y	Y1	Y

Note: 1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, No QP for LT motor upto 50KW.

2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard
3. Makes of major bought out items for HT motors will be subject to NTPC approval.
4. Y1 = for HT Motor / Machines only.

PROJECT SPECIFIC GENERAL REQUIREMENT FUNCTIONAL GUARANTEES

SUB-SECTION-VI

FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES

FUNCTIONAL GUARANTEES, LIQUIDATED DAMAGES FOR SHORTFALL IN PERFORMANCE AND PERFORMANCE GUARANTEE TESTS

1.00.00 GENERAL

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)".

2.00.00 PERFORMANCE GUARANTEES / PERFORMANCE TESTS

2.01.00 **General Requirements**

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.

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.

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.

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.

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.

2.01.06 It shall be responsibility of the Contractor to make the plant ready for the performance guarantee tests.

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

(h) Scheme showing measurement points.

(i) Sample calculation.

(j) Acceptance criteria.

(k) Any other information required for conducting the test.

2.03.00 **Test Reports**

After the conductance of Performance test, the Contractor shall submit the test evaluation report of Performance test results to Employer promptly but not later than one month from the date of conductance of Performance test. Preliminary test reports shall be submitted to the Employer after completing each test run. Four (4) hard copies and two (2) soft copies on CD-ROM of each test report of final conducted test on each equipment/plant/system shall be submitted to Employer for approval.

2.03.01 Performance Guarantee Tests on the equipments/systems not covered in this Sub-section shall be carried out as per the procedure/test codes specified in respective detailed specifications.

2.04.00 **Acceptance of Guarantee Test Results**

(i) For Category-I Guarantees

In case during performance guarantee test(s) it is found that the equipment/system has failed to meet the guarantees, the Contractor shall carry out all necessary modifications and/or replacements to make the equipment/system comply with the guaranteed requirements at no extra cost to the Employer and re-conduct the performance guarantee test(s) with Employer's consent. In case the specified performance guarantee(s) are still not met but are achieved within the Acceptable Shortfall Limit as specified at **clause 3.00.00** of this sub-section, Employer will accept the equipment/system/plant after levying liquidated damages as per **clause 3.00.00** of this sub-section. However, if, the demonstrated performance guarantee(s) continue to be beyond the stipulated Acceptable Shortfall Limit, even after the above modifications/replacements within ninety (90) days or a reasonable period allowed by the Employer, after the tests have been completed, the Employer will have the right to either of the following:

Reject the equipment / system / plant and recover from the Contractor the payments already made

OR

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 for unit capacity of 500 MW. For 200 MW / 210 MW units where common absorber has been specified for two / three units based on scope of supply, LD values are applicable for combination of units as indicated in the clause 3.00.00 The liquidated damages shall be pro-rated for the fractional parts of the deficiencies.

(ii) For Category-II Guarantees

In case during performance guarantee test(s) it is found that the equipment/ system has failed to meet the guarantees, the Contractor shall carry out all necessary modifications and/or replacements to make the equipment/system comply with the guaranteed requirements at no extra cost to the Employer and re-conduct the performance guarantee test(s) with Employer's consent. In case the specified performance guarantee(s) are still not met even after the above modifications/replacements with in ninety (90) days or a reasonable period allowed by the Employer, after the tests have been completed, the Employer will have the right to either of the following:

Reject the equipment /system / plant and recover from the Contractor the payments already made.

OR

Accept the equipment/system after assessing the deficiency in respect of the various ratings, performance parameters and capabilities and recover from the contract price an amount equivalent to the damages as determined by the Employer. Such damages shall, however be limited to the cost of replacement of the equipment(s)/system(s), replacement of which shall remove the deficiency so as to achieve the guaranteed performance. These parameters/capacities shall be termed as “Category-II” Guarantees.

3.00.00 AMOUNT OF LIQUIDATED DAMAGES (LD) APPLICABLE FOR GUARANTEES FOR EACH PROJECT

The rate of liquidated damages and acceptable shortfall limits for different guarantees shall be as under and such liquidated damages shall be deducted from the Contract Price of the project.

RAMAGUNDAM (3X500 MW)

Sl.No	**Guarantee**	**Rate of Liquidated Damage (LD)**	Acceptable Shortfall Limit with LD
i)	**SO2 Removal Efficiency** For shortfall in guaranteed SO2 removal efficiency in percentage points under conditions stipulated in clause 4.01.00 (i) of Sub-Section-VI, Part A, Section-VI.	**INR** 2,451,908 /- (INR Two Million Four Hundred Fifty One Thousand Nine Hundred Eight only) for every 0.1% point shortfall in SO2 removal efficiency from the guaranteed value.	(-)0.25% point from the guaranteed SO2 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** 249,478 /- (INR Two Hundred Forty Nine Thousand Four Hundred Seventy Eight only) for every KW increase in Auxiliary power consumption from the guaranteed value.	(+)1% of the guaranteed auxiliary power consumption

RAMAGUNDAM St-II (3X200 MW) Common FGD system

Sl.No	Guarantee	Rate of Liquidated Damage (LD)	Acceptable Shortfall Limit with LD
i)	**SO2 Removal Efficiency** For shortfall in guaranteed SO2 removal efficiency in percentage points under conditions stipulated in clause 4.01.00 (i) of Sub-Section-VI, Part A, Section-VI.	**INR** 3,633,561/- (INR Three Million Six Hundred Thirty Three Thousand Five Hundred Sixty One only) for every 0.1% point shortfall in SO2 removal efficiency from the guaranteed value.	(-)0.25% point from the guaranteed SO2 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** 20,812,843/- (INR Twenty Million Eight Hundred Twelve Thousand Eight Hundred Forty 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** 249,478 /- (INR Two Hundred Forty Nine Thousand Four Hundred Seventy Eight only) for every KW increase in Auxiliary power consumption from the guaranteed value.	(+)1% of the guaranteed auxiliary power consumption

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES
	NOTES APPLICABLE FOR EACH PROJECT: i) Each of the liquidated damages specified above shall be independent and these liquidated damages shall be levied concurrently as applicable. ii) 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) 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. iv) The LD values are applicable on per unit basis for unit capacity of 500 MW. For 200 MW / 210 MW units common absorber has been specified for two / three units based on scope of supply and LD values are applicable for combination of units as indicated in the clause 3.00.00
4.00.00	**GUARANTEES PARAMETERS**
4.01.00	**Guarantees Under Category-I** **The Performance Guarantees which attract Liquidated Damages (LD) are as follows:** The following shall be guaranteed by the Bidder under guarantee point condition of Sub- Section-V, Part-A of section- VI: **(i) SO_2 removal Efficiency** The Contractor shall guarantee that SO_2 removal efficiency shall not be less than the value specified under guarantee point conditions (as specified in Clause 1.00.00/2.00.00/3.00.00 Sub-section-V, Part-A of Section-VI applicable for respective project). (To be conducted as per the stipulation of Cl. no. 6.00.00 of this sub-section.) **(ii) Limestone Consumption** 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 Clause 1.00.00/2.00.00/3.00.00 Sub-section-V, Part-A of Section-VI applicable for respective project). **(iii) Auxiliary Power Consumption** 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 Clause 1.00.00/2.00.00/3.00.00

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.

4.02.00 Guarantees Under Category-II

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

(i) Wet ball Mill capacity at rated fineness

The contractor shall demonstrate the guaranteed capacity of each limestone pulverizer under the following conditions:

i)	Limestone 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)
ii)	Limestone Quality :	All available quality from the specified range.

(ii) Wet ball Mill wear parts guarantee

Contractor shall demonstrate the life of wet ball Mill wear parts in line with requirements stipulated in Part B of the Technical Specification. The establishment of the above guarantee shall be based on the operating records available at the Power station and will be computed for each pulverizer based on actual total hours of operation.

(iii) Wet ball Mill ball consumption

Contractor shall guarantee ball consumption per ton of limestone throughput in line with requirements stipulated in Part B of the Technical Specification. Contractor shall furnish the minimum ball diameter below which the balls shall be replaced.

(iv) Vacuum Belt Filter Capacity

Contractor shall demonstrate the Designed Capacity of the Vaccum Belt Filters to dewater the quantity of gypsum with the specified purity and moisture content as specified in Part B of the Technical Specification.

(v) Gypsum Purity

The contractor shall demonstrate that the purity of the gypsum produced shall not be less than 90%, chloride content shall not be more than 100ppm and the moisture content shall not be more than 10% for guarantee point condition.

(vi) NOT USED

(vii) Performance characteristics of fans (capacity, head developed, etc.).

(viii) Margins on fans in case Booster Fan is provided by the Contractor.

Booster Fans - As specified in Part B of **Technical Specifications**

(ix) Passenger cum Goods Elevator for FGD absorber & Limestone Grinding Building: Over load tests, travel and hoist speed checks.

(x) Noise

All the plant, equipment and systems covered under this specification shall perform continuously without exceeding the noise level over the entire range of output and operating frequency specified in Part-C of Section-VI of the technical specifications.

Noise level measurement shall be carried out using applicable and internationally acceptable standards. The measurement shall be carried out with a calibrated integrating sound level meter meeting the requirement of IEC 651 or BS 5969 or is 9779.

Sound pressure shall be measured all around the equipment at a distance of 1.0 m horizontally from the nearest surface of any equipment/ machine and at a height of 1.5 m above the floor level in elevation.

A minimum of 6 points around each equipment shall be covered for measurement. additional measurement points shall be considered based on the applicable standards and the size of the equipment. the measurement shall be done with slow response on the a - weighting scale. the average of a-weighted sound pressure level measurements expressed in decibels to a reference of 0.0002 micro bar shall not exceed the guaranteed value. corrections for background noise shall be considered in line with the applicable standards. all the necessary data for determining these corrections, in line with the applicable standards, shall be collected during the tests.

(xi) Mist Outlet Droplet Content

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.

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.

(xii) Availability of FGD Plant

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

(xiii) Air Conditioning System

A. Following shall be demonstrated at Shop

1) Capacity and static pressure of AHU fans at its rated duty point.

B. Following shall be demonstrated at Site

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.

(xiv) Ventilation System

A. Following shall be demonstrated at Shop

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.

B. Following shall be demonstrated at Site

1) Vibration & Noise level of centrifugal fans & pumps of UAF units.

(xv) Compressed Air System

a) Following shall be demonstrated at shop:

i) Capacity and discharge pressure of each air compressor.

b) Following shall be demonstrated at site:

ii) Dew point of air at the outlet of air drying plants of air compressor.

iv) Pressure drop across air drying plant .

v) Vibration and noise level of air compressors, blowers of air drying plant (if applicable)

(xvi) Equipment Cooling Water System

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.

(xvii) Limestone Handling System and Gypsum Handling System

a) Limestone Handling Plant

(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 tippling rate of truck tipplers.

b) Gypsum Handling Plant

The Bidder shall demonstrate the guaranteed conveying from belt filter to storage shed/silo including all intermediate equipment & conveyors.

5.00.00 AUXILIARY POWER CONSUMPTION (PA) FOR EACH PROJECT

The unit auxiliary power consumption shall be calculated using the following relationship.

$P_a = (P_{a1} + P_{a2} + \ldots\ldots\ldots + P_{an})/n$

$P_{an} = P_{un} + T_{Ln}$

P_a = Guaranteed Auxiliary Power Consumption

P_{an} = Auxiliary Power Consumption for unit # n

(Where “n” is the unit number e.g. 1, 2, ……)

P_{un} = Power consumed by the auxiliaries of the unit under test

T_{Ln} = Losses of the transformers supplied by bidder based on works test reports

While guaranteeing the auxiliary power consumption 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:

~~i. Absorber Recirculation Pump(s)/Gas Cooling Pumps~~

~~ii. Absorber Oxidation Air Blower(s)~~

iii. Absorber Oxidation Tank Agitators

iv. Gypsum Bleed Pumps

v. Limestone Gravimetric feeder, Wet ball mill and their integral Auxiliaries divided by the number of units in the project

vi. Limestone Slurry Pump(s)

vii. Vacuum Belt Filter, Vacuum Pump and its integral auxiliaries divided by the number of units in the project

viii. Power consumption of all working Booster water pumps (if provided) to ACW pumps after PHE divided by the number of units in the project

ix. Power consumption of Clarified water pumps (if provided) and Clarified booster water pumps (if provided) divided by the number of units in the project

x. Power consumption of Process water pump(s) divided by the number of units in the project

xi. Mist Eliminator Wash Water pump(s)

xii. Power consumption of Belt Filter Wash Water Pump divided by the number of units in the project

xiii. Power consumption of total number of DM Cooling (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

xiv. Power consumption of total number of Auxiliary Cooling (working) water pump/Permeate water pump to supply cooling water on the secondary side

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES
	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 xv. Booster Fans xvi. Power consumption of Limestone Slurry Tank Agitator(s) divided by the number of units in the project xvii. Power consumption of Filtrate Pump(s) divided by the number of units in the project xviii. Power consumption of Cloth Wash Water Pump divided by the number of units in the project xix. Power consumption of Hydro-cyclone and Waste Water Pump divided by the number of units in the project xx. Power consumption of all other continuous running Agitators divided by the number of units in the project xxi. Air Conditioning System (*) Total Power consumption at motor input terminals of working units (i.e. excluding stand-by) at its rated duty point of compressor and condenser fans of air cooled condensing unit, Air handling unit (AHU) fans for the Air conditioning system of FGD Control Room Building divided by total nos. of units in respective project xxii Total power consumption at motor input terminal at rated duty of fan of UAF divided by total nos. of units in respective project. (*) ((*) Above guaranteed power consumption values shall be at 20 deg C for centrifugal fans of AHUs and at 30 deg C for centrifugal fans of UAF units and at an elevation of RL (referring to GLP of respective projects) for both AHUs and UAF centrifugal fans.) 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. xxiv) Power consumption of clarified Water Pumps at rated capacity and head divided by the no of units of the project for Singrauli STPP-I & II (5X200MW) & (2X500MW). xxv) Power consumption of clarified Water Pumps at rated capacity and head divided by the no of units of the project for Farakka STPP-I (3X200MW). xxvi) Power consumption of clarified Water Pumps at rated capacity and head divided by the no of units of the project for Farakka STPP-II (2X500MW). xxvi) Power consumption of clarified Water Pumps at rated capacity and head divided by the no of units of the project for Rihand STPP-I (2X500MW).

xxvii) Air Conditioning System (*)

Total Power consumption at motor input terminals of working units (i.e. excluding stand-by) at its rated duty point of compressor and condenser fans of air cooled condensing unit, Air handling unit (AHU) fans for the Air conditioning system of FGD Control Room Building divided by total nos. of units in respective project..

xxviii) Total power consumption at motor input terminal at rated duty of fan of UAF divided by total nos. of units in respective project. (*)

((*) Above guaranteed power consumption values shall be at 20 deg C for centrifugal fans of AHUs and at 30 deg C for centrifugal fans of UAF units and at an elevation of RL (referring to GLP of respective projects) for both AHUs and UAF centrifugal fans.)

xxix) 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

NOTE:

1. 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.

2. The bidder shall furnish a list of equipments to be covered under auxiliary power consumption, which shall be subject to Employer's approval.

3. Transformer losses (TL) shall be considered as per following (as applicable)- Aux/LT Outdoor/ LT Indoor Transformer: 100 % No load loss and 25 % of Copper Losses.

4. Auxiliary power shall be measured without SCR (De-NOx) system.

5. Auxiliary power shall be measured at the switchgear of the drives.

6.00.00 METHOD OF COMPUTING TEST EFFICIENCY OF FGD

The performance tests shall be carried out in accordance with ASME PTC 40 (1991) 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.

7.00.00 METHOD OF COMPUTING AVAILABILITY

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.

Availability 'A' in %:

$$A = \frac{Tc \times 100\%}{Tk}$$

Tc – recorded time of FGD operation, expressed in hours,

Tk – recorded time of boiler operation, expressed in hours,

However, it is required that:

(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,

(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:

(a) 200 mg/Nm^3 (6% O_2 dry) for units having capacity of 500 MW

(b) 600 mg/Nm^3 (6% O_2 dry) for units having capacity of 200 MW & 210 MW

(iii) 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,

(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.

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 required for demonstration of availability demonstration guarantee, Bidder to should clearly indicate along with their offer.

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES
	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.

CLAUSE NO.	GUARANTEE TEST PROCEDURE

ANNEXURE – IIA

FORMAT FOR SUBMISSION OF GUARANTEE TEST PROCEDURE

Clause No. as per LOA/ Tech. Specs.	Provision of LOA / Tech. Specs.	Name and Methodology of Test proposed by Vendor	NTPC comments on the tests proposed by vendor

CLAUSE NO.	GUARANTEE TEST PROCEDURE

APPENDIX-IV

GUARANTEE TEST PROFORMA

POWER MEASUREMENT

Project :

Package :

Date :

1. Equipment/Stream Composition :
2. Motor Description :
3. Sr. No. of meters used :
4. Date of Calibration of instrument and name of test house :
5. Multiplying factor (M.F.) of the wattmeter :
6. Wattmeter Readings (to be taken at 1 minute intervals) :

Sl. No.	Measurement Terminal Location	Time	Voltage (Volts)	Current (amps)	kw Reading M.F.		Total (W1+W2) MF kw	Remarks
					W1	W2		

CLAUSE NO.	GUARANTEE TEST PROCEDURE

APPENDIX-IV

7. **Energymeter Readings**

Sl.	Equip-Ment	Time Duration		Energymeter Readings kwHr		Equipment kw (R2-R1)/ (t2-t1)	Remarks
		Initial	Final	Initial	Final		

*Reason and duration for system trip/stop may be recorded in remarks column.

NTPC **Contractor**

CLAUSE NO.	GUARANTEE TEST PROCEDURE

APPENDIX-V

GUARANTEE TEST PROFORMA

VIBRATION LEVEL MEASUREMENTS

Project :

Package :

Date :

Time :

Details of vibration Level Meter

1. Make
2. Model & Sl.No.
3. Date of calibration with name of Test House

Sl.No.	Equipment	Pick *Point	Vibration level Amplitude/Velocity		
			Horizontal Micron/ mm/ sec.	Vertical micron/ mm/sec.	Axial Micron / mm/sec.

* Reading shall be taken at all the bearings of motor, gear box and driven equipment. In case of conveyor galleries, vibrations shall be measured at min. three locations, at midpoint of stringer between two short supports.

NTPC **Contractor**

CLAUSE NO.	GUARANTEE TEST PROCEDURE

APPENDIX-VI

GUARANTEE TEST PROFORMA

NOISE LEVEL MEASUREMENT

Project :

Package :

Date :

Details of Sound Level Meter

1. Make
2. Model
3. Date of calibration with name of Test House

Sl.No	Equipment with location	Equipment load/capacity	Measurement* point no.	Sound level dBA.	Remarks

NTPC **Contractor**

* For each equipment location, a Projected Plan Diagram shall be made and the location of measurement points shall be identified.

	TITLE: (3x200+3x500) MW RAMAGUNDAM FGD TECHNICAL SPECIFICATIONS FOR AGITATORS OF FGD SLURRY TANKS	SPECIFICATION No: PE-TS-467-571-18000-A002	
		SECTION-I, SUB-SECTION-C2C	
		REV. 00	DATE: OCT 2021
		SHEET : 1 OF 1	

CUSTOMER SPECIFICATION: PAINTING 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	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. SP1 Solvent cleaning SP2 Application of rust converter (Ruskil or equivalent grade) SP3 Power tool cleaning SP4 Shot blasting (shot blasting shall be used as surface preparation method for hot worked pipes prior to application of primer) SP4* Shot blast cleaning/ abrasive blast cleaning to SA21/2 (near white metal) 35-50 microns SP5 Shot blasting/ abrasive blasting. SP6 Emery sheet cleaning/Manual wire brush cleaning.
1.06.00	**APPLICATION OF PRIMER/PAINT**
1.06.01	The paint/primer manuacturer'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
	as the surface is prepared. Primer coat shall be applied prior to intermediate and finish coats.
1.06.04	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.
1.06.05	Following are the Primer/painting schemes envisaged herein: PS3 - Zinc Chrome Primer (Alkyd base) by brush/Spray to IS104. PS3* - Zinc Chrome primer (Alkyd base) by dip coat. PS4 - Synthetic Enamel (long oil alkyd) to IS2932. PS5 - Red Oxide Zinc Phosphate primer (Alkyd base) to IS 12744 PS9 - Aluminium paint to IS 2339. PS9* - Heat resistant Aluminium paint to IS-13183 Gr.-1 PS13 - Rust preventive fluid by spray, dip or brush. PS14 - weldable primer-Deoxaluminate or equivalent. PS16 - High Build Epoxy CDC mastic `15' . PS17 - Aliphatic Acrylic Polyurethane CDE134 ,%V=40.0(min.) PS18 - Epoxy based TiO2 pigmented coat PS19 - Epoxy Zinc rich primer (92% zinc in dry film (min.), %VS=40.0(min.) PS-20 - Epoxy based finish paint
1.06.06	All weld edge preparation for site welding shall be applied with one coat of wieldable primer.
1.06.07	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.
1.06.08	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.
1.06.09	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. The paint shall be applied in three stages i.e. primer, intermediate and finish coats in following manner: ▪ Primer coat – Epoxy based zinc phosphate ▪ Intermediate - Epoxy based TiO2 pigmented coat ▪ Finish coat - Epoxy based finish coat 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. c) Surface preparation before painting shall be carried out according to requirement indicated in this sub-section and international standard

CLAUSE NO.	TECHNICAL REQUIREMENTS
1.06.10	A) Specification for the application of Epoxy coating for internal protection of DM tank & other vessels/tanks (as applicable) shall be as follows: Primer : One coat of unmodified epoxy resin along with polymide hardener. Paint : Two (2) coats unmodified epoxy resin along with Aromatic adduct hardener. Total thickness of primer and paint should not be less than 400 microns. B) Specification for application of chlorinated Rubber paint for external protection vessel, tanks, piping, valves & other equipments shall be as follows: i) For Indoor vessel, tanks, piping, valves & other equipments: (a) Surface preparation shall be done either manually or by any other approved method. (b) Primer coat shall consist of one coat of chlorinated rubber based zinc phosphate primer having minimum DFT of 50 microns. (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. (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. Total DFT of paint system shall not be less than 150 microns. ii) For Outdoor vessel, tanks, piping, valves & other equipments: (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. (b Primer coat shall consist of one coat of epoxy resin based zinc phosphate primer having minimum DFT of 100 microns. (c) Intermediate coat (or under coat) shall consist of epoxy resin based paint pigmented with Titanium dioxide with minimum DFT of 100 microns. (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. The paint may be applied in one coat, in case high built paint is used, otherwise two coats shall be applied. Total DFT shall not be less than 300 microns.

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.

BHEL	BHEL, Ranipet - 632 406, India. Quality Assurance Department. Painting Scheme	BHEL DOC No: PS:RAMA:FGD:G208 Rev: 00 Dt: 21/05/2020 NTPC Contract No: CS-3120/3130-109(3)-9-FC-NOA-6845 Dt: 22/08/2019 NTPC Doc No: 3130-109-PVM-H-001 Rev: 00 Dt: 21/05/2020
Project	Ramagundam STPS Stage- I & II FGD Package - BHEL Cust Nos: G208-G210 (3x200 MW) & G509-G511 (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)	

Ramagundam STPS Stage – I & II (3x200 MW + 3x500 MW) FGD PACKAGE

PAINTING SCHEME for FGD SYSTEM, BOOSTER FANS, GATES & DAMPERS

Prepared By	Reviewed & Approved By
21/05/20	21/05/2020
K.S. Gopakumar, Dy Engineer / QA	Venkanna Rupani, Dy Manager / QA

Record of Revision

Rev No	Date	Details Of Revision
00	21/05/2020	First Submission

	BHEL, Ranipet - 632 406, India. **Quality Assurance Department.** **Painting Scheme**	BHEL DOC No: **PS:RAMA:FGD:G208** Rev: **00** Dt: **21/05/2020** **NTPC Contract No: CS-3120/3130-109(3)-9-FC-NOA-6845 Dt: 22/08/2019** **NTPC Doc No: 3130-109-PVM-H-001** Rev: **00 Dt: 21/05/2020**
Project	**Ramagundam STPS Stage- I & II FGD Package - BHEL Cust Nos: G208-G210 (3x200 MW) & G509-G511 (3x500 MW)**	

1. FANS

Sl No	Surface Location	PGMA	Surface Preparation	Primer & Intermediate Coats: Paint	Primer & Intermediate Coats: DFT (µm min)	Finish Coat: Paint	Finish Coat: DFT(µm min)	Total DFT (µm min)
1	Axial Fan tool & fixtures **(Clause 20.03.00 of Part- C Section VI)**	55 000	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
2	Booster Fan foundation material	55 081	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.					
3	Booster Fan Handrails & Insert **(Clause 31.06.00 of Sec.VI, Part-B, Subsection- IV-D)**	55 082	Blast cleaning to Sa 2½/ Acid pickling	Hand rails, Gratings- Hot dip galvanizing to 610gms/sq.m (minimum) and to a coating thickness of 87µm (min).				
4	Booster Fan Handrails & Insert- Structural items other than the above **(Clause 31.03.00 of Sec.VI, Part-B, Subsection- IV-D)**	55 082	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

	BHEL, Ranipet - 632 406, India. **Quality Assurance Department.** **Painting Scheme**	BHEL DOC No: **PS:RAMA:FGD:G208** Rev: **00** Dt: **21/05/2020** **NTPC Contract No: CS-3120/3130-109(3)-9-FC-NOA-6845 Dt: 22/08/2019** **NTPC Doc No: 3130-109-PVM-H-001** Rev: **00 Dt: 21/05/2020**
Project	**Ramagundam STPS Stage- I & II FGD Package - BHEL Cust Nos: G208-G210 (3x200 MW) & G509-G511 (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)	
5	Axial booster cooling/ seal fan **(Clause 1.04.00 of Part- A Section VI)**	55 084	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 MIO/Tio2 DFT- 100µ	100 100	**Finish:** One coat of Epoxy based finish paint 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
6	Booster fan canopy for motor **(Clause 1.04.00 of Part- A Section VI)**	55 089	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 MIO/Tio2 DFT- 100µ	100 100	**Finish:** One coat of Epoxy based finish paint 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
7	Axial booster fan rotor **(Clause 20.03.00 of Part- C Section VI)**	55 287	Power Tool Cleaning to St3 (SSPC-SP3)	Two coats of Epoxy based Zinc phosphate primer (Two pack system) to IS 13238; DFT- 30µ/coat	60	NIL	--	60
8	Axial booster fan stator **(Clause 20.03.00 of Part- C Section VI)**	55 587	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:RAMA:FGD:G208** Rev: **00** Dt: **21/05/2020** **NTPC Contract No: CS-3120/3130-109(3)-9-FC-NOA-6845 Dt: 22/08/2019** **NTPC Doc No: 3130-109-PVM-H-001** Rev: **00 Dt: 21/05/2020**
Project	**Ramagundam STPS Stage- I & II FGD Package - BHEL Cust Nos: G208-G210 (3x200 MW) & G509-G511 (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)	
9	Axial booster fan coupling **(Clause 1.04.00 of Part- A Section VI)**	55 880	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 MIO/Tio2 DFT- 100µ	100 100	**Finish:** One coat of Epoxy based finish paint 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
10	Booster fan LOS with lubricant **(Clause 1.04.00 of Part- A Section VI)**	55 980	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 MIO/Tio2 DFT- 100µ	100 100	**Finish:** One coat of Epoxy based finish paint 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
11	Booster fan actuator **(Clause 1.04.00 of Part- A Section VI)**	55 983	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 MIO/Tio2 DFT- 100µ	100 100	**Finish:** One coat of Epoxy based finish paint 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:RAMA:FGD:G208** Rev: **00** Dt: **21/05/2020** **NTPC Contract No: CS-3120/3130-109(3)-9-FC-NOA-6845 Dt: 22/08/2019** **NTPC Doc No: 3130-109-PVM-H-001** Rev: **00 Dt: 21/05/2020**
Project	**Ramagundam STPS Stage- I & II FGD Package - BHEL Cust Nos: G208-G210 (3x200 MW) & G509-G511 (3x500 MW)**	

2. FGD SYSTEM

Sl No	Surface Location	PGMA	Surface Preparation	Primer & Intermediate Coats: Paint	Primer & Intermediate Coats: DFT (µm min)	Finish Coat: Paint	Finish Coat: DFT(µm min)	Total DFT (µm min)
1	Slurry recirculation pump System **(Referred from cl. 7.05.00 of Section-VI, Part-B, Sub section-I-M5)**	FW 212	Power Tool Cleaning to St3 (SSPC-SP3)	**Primer:** Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats) **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
2	Absorber System Internals – Structural items **(Clause 1.04.00 of Part- A Section VI)**	FW 213	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 MIO/Tio2, DFT- 100µ	100 100	**Finish:** One coat of Epoxy based finish paint 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
3	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)**	FW 215 FW 216 FW 217 FW 218	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 MIO/Tio2 DFT- 100µ	100 100	**Finish:** One coat of Epoxy based finish paint 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

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Project	**Ramagundam STPS Stage- I & II FGD Package - BHEL Cust Nos: G208-G210 (3x200 MW) & G509-G511 (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)	
4	Absorber System- Base **(Clause 31.03.00 of Sec.VI, Part-B, Subsection- IV-D)**	FW 219	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
5	Absorber system structures, Absorber shear plate, Duct supports, Structures for RC pump house& Hook up duct structure **(Clause 31.03.00 of Sec.VI, Part-B, Subsection- IV-D)**	FW 220 FW 231 FW 232 FW 233 FW 234 FW 236 FW 238	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

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Project	**Ramagundam STPS Stage- I & II FGD Package - BHEL Cust Nos: G208-G210 (3x200 MW) & G509-G511 (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)	
6	Absorber system casing bottom- Outside surfaces **(Clause 31.03.00 of Sec.VI, Part-B, Subsection- IV-D)** Inside surfaces are of C276 cladded sheets, hence no paint is envisaged.	FW 221	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
7	Absorber system casing top- Outside surfaces **(Clause 31.03.00 of Sec.VI, Part-B, Subsection- IV-D)** Inside surfaces are of C276 cladded sheets, hence no paint is envisaged.	FW 222	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

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Project	**Ramagundam STPS Stage- I & II FGD Package - BHEL Cust Nos: G208-G210 (3x200 MW) & G509-G511 (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)	
8	Absorber system accessories **(Clause 20.03.00 of Part- C Section VI)**	FW 223	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
9	Emergency Quench water tank- Outside surfaces **(Clause 31.03.00 of Sec.VI, Part-B, Subsection- IV-D)**	FW 226	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
10	Emergency Quench water tank- Inside surfaces	FW 226	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)				
11	Emergency quench system, Handling Equipment RC pump **(Clause 20.03.00 of Part- C Section VI)**	FW 227 FW 249	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	Air oxidation system, Viewing ports (Without glass)	FW 230 FW 239	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

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 20.03.00 of Part- C Section VI)								
13	Absorber W/D interface, W/D wash system, Slurry distribution system, Oxidation Air distribution system **(Clause 1.04.00 of Part- A Section VI)**		FW 228 FW 229 FW 243 FW 244	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 MIO/Tio2 DFT- 100µ	100 100	**Finish:** One coat of Epoxy based finish paint 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
14	Expansion joint between bypass **(Clause 20.03.00 of Part- C Section VI)**	Flue gas swept surface	FW 251	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (two coats)	60	--	--	60
		Insulated surfaces		Power Tool Cleaning to St3 (SSPC-SP3)	HR Aluminium paint to IS 13183 Gr.II (upto 400 deg C)	40	NIL	--	40
15	Expansion joint **(Clause 20.03.00 of Part- C Section VI)**	Flue gas swept surface	FW 252	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60
		Insulated surfaces		Power Tool Cleaning to St3 (SSPC-SP3)	HR Aluminium paint to IS 13183 Gr.II (upto 400 deg C)	40	NIL	--	40
16	Ducts between bypass duct inlet& booster fan	Flue gas swept surface	FW 255	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60

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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 20.03.00 of Part- C Section VI)	Insulated surfaces		Power Tool Cleaning to St3 (SSPC-SP3)	HR Aluminium paint to IS 13183 Gr.II (upto 400 deg C)	40	NIL	--	40
17	Ducts between Booster fan& Absorber **(Clause 20.03.00 of Part- C Section VI)**	Flue gas swept surface	FW 256	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60
		Insulated surfaces		Power Tool Cleaning to St3 (SSPC-SP3)	HR Aluminium paint to IS 13183 Gr.II (upto 400 deg C)	40	NIL	--	40
18	Ducts between Absorber& Stack **(Clause 20.03.00 of Part- C Section VI)**	Flue gas swept surface	FW 257	Power Tool Cleaning to St3 (SSPC-SP3)	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	60	NIL	--	60
		Insulated surfaces		Power Tool Cleaning to St3 (SSPC-SP3)	HR Aluminium paint to IS 13183 Gr.II (upto 400 deg C)	40	NIL	--	40
19	Duct structure between bypass duct& Booster fan **(Clause 31.03.00 of Sec.VI, Part-B, Subsection- IV-D)**		FW 260	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

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Sl 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	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)		
20	Duct structure between Booster fan& Absorber **(Clause 31.03.00 of Sec.VI, Part-B, Subsection- IV-D)**	FW 261	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
21	Duct structure between Absorber & Stack **(Clause 31.03.00 of Sec.VI, Part-B, Subsection- IV-D)**	FW 262	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

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Sl 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	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)		
22	Foundation material for duct structures, Absorber, Elevator, RC pump shed, tanks, Silo Structure, pipe racks	FW 280 FW 281 FW 282 FW 283 FW 740 FW 760 FW 762 FW 763	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.					
23	Structures for Emergency Quench water tank Structures for Elevator **(Clause 31.03.00 of Sec.VI, Part-B, Subsection- IV-D)**	FW 285 FW 292	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

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Sl No	Surface Location	PGMA	Surface Preparation	Primer & Intermediate Coats		Finish Coat		Total DFT (µm min)
				Paint	DFT (µm min)	Paint	DFT(µm min)	
24	Elevator and accessories **(Clause 20.03.00 of Part- C Section VI)**	FW 293 FW 716	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
25	Structures for booster fan handling **(Clause 31.03.00 of Sec.VI, Part-B, Subsection- IV-D)**	FW 310	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
26	Galleries and railings for Stairs, Absorber, Dampers, Ducts, Tanks **(Clause 31.06.00 of Sec.VI, Part-B, Subsection- IV-D)**	FW 214 FW 237 FW 250 FW 610 FW 612 FW 613 FW 712 FW 722	Blast cleaning to Sa 2½/ Acid pickling	Hand rails, Gratings- Hot dip galvanizing to 610gms/sq.m (minimum) and to a coating thickness of 87µm (minimum)				

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Sl No	Surface Location	PGMA	Surface Preparation	Primer & Intermediate Coats		Finish Coat		Total DFT (µm min)
				Paint	DFT (µm min)	Paint	DFT(µm min)	
27	Galleries and railings for Stairs, Absorber, Dampers, Ducts, Tanks – Structures other than the above **(Clause 31.03.00 of Sec.VI, Part-B, Subsection- IV-D)**	FW 237 FW 610 FW 612 FW 613 FW 722	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
28	Slurry pumps & accessories, Water pumps **(Referred from cl. 7.05.00 of Section-VI, Part-B, Sub section-I-M5)**	FW 701 FW 702	Power Tool Cleaning to St3 (SSPC-SP3)	**Primer:** Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats) DFT- 30µ; **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
29	Monorail for hoist & cranes **(Clause 31.03.00 of Sec.VI, Part-B, Subsection- IV-D)**	FW 710	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

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Sl 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	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)		
30	Handling Equipment- Hoists& Man hole door **(Clause 20.03.00 of Part- C Section VI)**	FW 713 FW 714 FW 717	Power Tool Cleaning to st3 (SSPC-SP3	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats) Idler roller shall be applied with two coats of 70 microns at shop	70	Synthetic Enamel to IS 2932 Shade: Grey white RAL 9002 (Two coats)	60	130
31	Agitator support **Clause 31.03.00 of Sec.VI, Part-B, Subsection- IV-D)**	FW 721	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
32	Limestone silo structures **Clause 31.03.00 of Sec.VI, Part-B, Subsection- IV-D)**	FW 730	Blast cleaning to Sa 2½ (Near white metal) with surface profile 40-60µm	**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	70	**Finish:** Two coats of two pack aliphatic isocyanate cured acrylic polyurethane paint to IS 13213 solid by volume min.55%±2)	70	240

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Project	**Ramagundam STPS Stage- I & II FGD Package - BHEL Cust Nos: G208-G210 (3x200 MW) & G509-G511 (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)	
			conforming to ISO 8501-1	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	100	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)		
33	Limestone Silo- Outside surfaces **Clause 31.03.00 of Sec.VI, Part-B, Subsection- IV-D)**	FW 731	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
34	Lime stone Silo- Inside surfaces (Conical portion)	FW 731	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

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Project	**Ramagundam STPS Stage- I & II FGD Package - BHEL Cust Nos: G208-G210 (3x200 MW) & G509-G511 (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)	
35	Lime stone Silo- Inside surfaces (Cylindrical portion)	FW 731	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
36	Air cannon silo, Bag filter & Fan assy, Nozzles& Flanges **(Clause 20.03.00 of Part- C Section VI)**	FW 723 FW 724 FW 725	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
37	Limestone silo approach platform, Platform for Pipe racks& Sub pipe racks **(Clause 31.06.00 of Sec.VI, Part-B, Subsection- IV-D)**	FW 733 FW 766 FW 767	Blast cleaning to Sa 2½/ Acid pickling	Hand rails, Ladders, Gratings- Hot dip galvanizing to 610gms/sq. m (minimum) and to a coating thickness of 87µm (minimum)				
38	Limestone silo approach platform, Pipe racks, Sub pipe racks platform- Structures other than the above **(Clause 31.03.00 of Sec.VI, Part-B, Subsection- IV-D)**	FW 733 FW 766 FW 767	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)	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	70	240

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Project	**Ramagundam STPS Stage- I & II FGD Package - BHEL Cust Nos: G208-G210 (3x200 MW) & G509-G511 (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)	
				DFT- 100µ		30 and colour change less than 2.0Δ E)		
39	Limestone Mill – Outside surfaces **(Clause 1.04.00 of Part- A Section VI)**	FW 735	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 MIO/Tio2 DFT- 100µ	100 100	**Finish:** One coat of Epoxy based finish paint 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
40	Lime stone mill- Inside surfaces	FW 735	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
41	Gypsum belt filter and accessories Structural items **(Clause 1.04.00 of Part- A Section VI)**	FW 738	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 MIO/Tio2 DFT- 100µ	100 100	**Finish:** One coat of Epoxy based finish paint 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

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Project	**Ramagundam STPS Stage- I & II FGD Package - BHEL Cust Nos: G208-G210 (3x200 MW) & G509-G511 (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)	
42	Lime stone 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)**	FW 742 FW 743 FW 744 FW 745 FW 747 FW 748 FW 785 FW 786 FW 800 FW 802	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
43	Lime stone 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	FW 742 FW 743 FW 744 FW 745 FW 747 FW 748 FW 749 FW 800 FW 802	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

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Project	**Ramagundam STPS Stage- I & II FGD Package - BHEL Cust Nos: G208-G210 (3x200 MW) & G509-G511 (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)	
44	Process water pipe accessories, Cooling pipe accessories **(Referred from cl. 7.05.00 of Section-VI, Part-B, Sub section-I-M5)**	FW 751 FW 752	Power Tool Cleaning to St3 (SSPC-SP3)	**Primer:** Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats) **Intermediate:** One coat of Synthetic Enamel intermediate coat to IS 2932; DFT- 50µ	60 50	**Finish:** Two coats of Synthetic Enamel to IS 2932, DFT- 50µ/ coat **Shade:** Grey white RAL 9002 Identification Tag: Sea Green Shade no: 217 as per IS 5	100	210
45	Slurry pipe accessories **(Referred from cl. 7.05.00 of Section-VI, Part-B, Sub section-I-M5)**	FW 753	Power Tool Cleaning to St3 (SSPC-SP3)	**Primer:** Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats) **Intermediate:** One coat of Synthetic Enamel intermediate coat to IS 2932; DFT- 50µ	60 50	**Finish:** Two coats of Synthetic Enamel to IS 2932, DFT- 50µ/ coat **Shade:** Grey white RAL 9002 Identification Tag: Sea Green Shade no: 217 as per IS 5	100	210
46	Service Air pipe accessories **(Referred from cl. 10.00 .00 of Section-VI, Part-B, Sub section-I-M3)**	FW 754	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 as per IS 5	60	120
47	Instrument air pipe accessories **(Referred from cl. 10.00 .00 of Section-VI, Part-B, Sub section-I-M3)**	FW 755	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 as per IS 5	60	120

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Project	**Ramagundam STPS Stage- I & II FGD Package - BHEL Cust Nos: G208-G210 (3x200 MW) & G509-G511 (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)	
48	All valves (Temp <95 deg C) **(Clause 20.03.00 of Part- C Section VI)**	FW 815 to FW 851	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
49	Structure for Pipe racks, Sub 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)**	FW 761 FW 765 FW 768 FW 769 FW 787	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
50	Supports for cable trays, Air receivers, commissioning& Mandatory spares, Tools & tackles **(Clause 20.03.00 of Part- C Section VI)**	FW 779 FW 798 FW 988 FW 996	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

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3. GATES & DAMPERS

Sl No	Surface Location	PGMA	Surface Preparation	Primer & Intermediate Coats: Paint	Primer & Intermediate Coats: DFT (µm min)	Finish Coat: Paint	Finish Coat: DFT(µm min)	Total DFT (µm min)
01	**Gates & Dampers** > 95^0 C Insulated Surfaces& Uninsulated surfaces	57 540 57 550 57 583	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	57 141	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 as per IS 5	60	120
03	Blower with Motor Knife Gate valve Mounting bracket Mandatory spares	57 491 57 497 57 209	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**	57 466 57 566	Blast cleaning to Sa 2½/ Acid Pickling	Hot Dip Galvanizing to 610 gm per sq. Meter (minimum) and to a coating thickness of 87 µm (minimum)				
05	Other Structural Items-Other than sl.no. 3 of above	57 466 57 566	Blast cleaning to Sa 2½ (Near white metal) with surface profile 40-	**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	70	**Finish:** Two coats of two pack aliphatic isocyanate cured acrylic polyurethane paint to IS 13213 solid by volume min.55%±2)	70	240

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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)		60µm conforming to ISO 8501-1	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	100	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)		

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:

SL NO	SURFACE LOCATION	SURFACE PREPARATION	PRIMER, INTERMEDIATE & FINISH
1	Paint damaged Components falling under Sl.no. 04,05,06,09,10,11 of Fans, Sl no.02,03,04, 05,06,07, 09, 13,19,20,21,23,25,27, 29, 31,32 33,38,39,41,42, 49 of FGD and Sl no. 5 of GAD.	Hand/ Power Tool cleaning to Bare metal to minimum 6 inches peripheral area adjoining to damaged area	Primer: Epoxy Zinc rich primer to IS 14589, 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 Sl Nos of Fans, FGD& GAD	Power Tool Cleaning to Bare metal	Primer and Finish: As given in respective scheme

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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

1. No painting is required for Galvanized, non-ferrous & stainless steel items, except as indicated above.
2. Machined items are to be applied with coat of temporary rust preventive oil
3. 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.
4. 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.
5. 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.
6. 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.
7. 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.
8. Painting requirement for all electrical equipment shall be as per the details identified in specification for the respective equipment.
9. 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.
10. Finish coat to be applied after an interval of min 10 hrs and within 6 months (after completion of intermediate coat).
11. Primer coat on steel shall be applied in shop immediately after blast cleaning by airless spray technique.
12. 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.

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Sl 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

SL NO	TYPE OF PAINT	SPECIFICATION OF PAINT	NO OF PACK	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	Corresponding shade no
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:RAMA:FGD:G208** Rev: **00** Dt: **21/05/2020** **NTPC Contract No: CS-3120/3130-109(3)-9-FC-NOA-6845 Dt: 22/08/2019** **NTPC Doc No: 3130-109-PVM-H-001** Rev: **00 Dt: 21/05/2020**
Project	**Ramagundam STPS Stage- I & II FGD Package - BHEL Cust Nos: G208-G210 (3x200 MW) & G509-G511 (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)	

PGMA Description & Product Details

Sl No	PGMA	PGMA Description	Product /Items Details
01	FW 212	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	FW 219	Absorber system base	Absorber tank bottom plate
03	FW 220	Absorber system structures	Absorber tank structure, Absorber tower structure, Spray headers structure
04	FW 221	Absorber system casing bottom	Absorber tank wall casing- bottom
05	FW 222	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	FW 223	Absorber system accessories	Nozzles and flanges, Inspection doors & Man holes, Viewing ports, Antifoam dosing equipment, Suction strainers- FRP
07	FW 226	Emergency Quench water tank	Base Plate & its supports, Roof, Shell
08	FW 227	Emergency Quench System	Emergency Quenching Spray Pipe, Nozzle for Emergency Pipe, Fasteners, Gaskets
09	FW 230	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	FW 244	Oxidation air distribution System	Pipe & Fittings, Flanges, Pipe Hanger, Bottom Elbow, Bottom sliding supports
11	FW 251	Expansion joint between bypass	Expansion joints, Seal Plates & Fasteners
12	FW 252	Expansion joint between scrubbers	Fabric & its fixing fasteners, Sleeves & Flanges, Gaskets
13	FW 255	Ducts between bypass duct inlet & booster fan	Plates & Stiffeners, Guide Vanes
14	FW 256	Ducts between Booster fan & Absorber	Plates & Stiffeners, Guide Vanes
15	FW 257	Ducts between Absorber & stack	Plates & Stiffeners, Guide Vanes
16	FW 260	Duct structure between bypass duct& Booster fan	Duct Supports, Gusset Plate, Divider plate, Internal Struts, Support bearings
17	FW 261 FW 262	Duct structure between booster fan& absorber & Absorber and Stack	Duct Supports, Gusset Plate, Divider plate, Internal Struts, Support bearings
18	FW 292	Structures for Elevator	Columns, Seal Plate, Bracings, Enclosure (Purlin& sheeting)

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Project	**Ramagundam STPS Stage- I & II FGD Package - BHEL Cust Nos: G208-G210 (3x200 MW) & G509-G511 (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)	

Sl No	PGMA	PGMA Description	Product /Items Details
19	FW 293	Elevator and accessories	Base Frame, Buffer Spring, Mast Section, Cage, Control Panel & AC, Mandatory Spares
20	FW 310	Structures for booster fan handling	Columns, Beams, Bracings, Seal plate
21	FW 610 FW 722	Galleries & railings for Scrubbers, Tank	Stairs, Handrail, Step treads, Floor grills, Ladders, Foundation bolts, Fasteners
22	FW 701	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
23	FW 710	Monorail for hoist& cranes	Insert Plate, Stiffener plate, Monorail beam
24	FW 721	Agitator support	Channels & Beams
25	FW 730	Limestone silo structures	Columns, Beams, Bracings, Seal plate, Angles, channels
26	FW 731	Limestone silo	Base plate & its supports, Shell, Roof
27	FW 723 FW 724 FW 725	Air cannon Bag filter Nozzles & flanges	Bag filter, Air cannon bin activator, Nozzles & Flanges
28	FW 733	Limestone silo approach platforms	Stairs, Handrail, Step treads, Floor grills, Ladders, Foundation bolts, Fasteners
29	FW 734	Limestone mill	Wet ball mill, Hydro cyclone- Mill area, Mill circuit pump, Mill separator tank with Agitator
30	FW 742	Lime stone slurry storage tank	Base plate & its supports, Shell, Roof
31	FW 743	Auxiliary Absorber tank	Base plate & its supports, Shell, Roof
32	FW 744	Filtrate tank	Base plate & its supports, Shell, Roof
33	FW 745	Wastage water tank	Base plate & its supports, Shell, Roof
34	FW 747	Hydro cyclone waste water tank	Base plate & its supports, Shell, Roof
35	FW 748 FW 785 FW 786	Process Water tank Belt filter washing tank Primary Hydro cyclone feed tank	Base plate & its supports, Shell, Roof
36	FW 751 FW 752	Process water pipe accessories Cooling water pipe accessories	CS/FRP Pipes & Fittings, Sight Glass, R Orifice, Gaskets & Fasteners
37	FW 753	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:RAMA:FGD:G208** Rev: **00** Dt: **21/05/2020** **NTPC Contract No: CS-3120/3130-109(3)-9-FC-NOA-6845 Dt: 22/08/2019** **NTPC Doc No: 3130-109-PVM-H-001** Rev: **00 Dt: 21/05/2020**
Project	**Ramagundam STPS Stage- I & II FGD Package - BHEL Cust Nos: G208-G210 (3x200 MW) & G509-G511 (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)	

Sl No	PGMA	PGMA Description	Product /Items Details
38	FW 754	Service air pipe accessories	GI Pipes & Fittings, Flexible Hose, Expansion Joint (Metallic), Hose connector, R Orifice, Gaskets & Fasteners
39	FW 755	Instrument air pipe accessories	SS Pipes & Fittings, Strainer(Y Type), Gaskets & Fasteners
40	FW 815 to FW 851	Valves and fittings	Globe valves, Ball Valves, Butterfly Valves, Diaphragm Valves, Gate Valves, Check Valves, Pinch Valves, Knife Gate Valves, Control Valves, Relief Valves
41	FW 761 FW 765	Structures for Pipe racks Structures for Sub pipe racks	Bracings Columns
42	FW 280 FW 281 FW 282 FW 283 FW 740 FW 760 FW 763	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
43	FW 766	Platforms for Pipe rack	Stairs, Handrail, Step treads, Floor grills, Ladders, Foundation bolts, Fasteners
44	FW 768 FW 769	Trestle for Main & sub Pipe racks	Truss, Beams, Supports for all Pipes
45	FW 779	Supports for cable tray	Double Sup Channel & Base plates, Single Sup Channel & Base plates Cantilever Arm, Fasteners & clamps, Brackets
46	FW 996	Tools	Erection , commissioning, special tools
47	FW 798	Air receivers	Instrument Air receivers, Any Instruments/Valves
48	FW 800	Clarified water tank	Base plate & its supports, Shell, Roof
49	FW 802	Neutralization tank & accessories	Base plate & its supports, Shell, Roof
50	FW 988 FW 997 FW 999	Commissioning spares & Mandatory spares	Startup & commissioning spares, Mandatory spares

	TITLE: (3x200+3x500) MW RAMAGUNDAM FGD TECHNICAL SPECIFICATIONS FOR AGITATORS OF FGD SLURRY TANKS	SPECIFICATION No: PE-TS-467-571-18000-A002	
		SECTION-I, SUB-SECTION-C3	
		REV. 00	DATE: OCT 2021
		SHEET : 1 OF 1	

TECHNICAL SPECIFICATION OF AGITATORS (ELECTRICAL PORTION)

	ELECTRICAL EQUIPMENT SPECIFICATION FOR AGITATOR **Ramagundam (FGD) STPP, Stage-I & II (3x200MW + 3x500 MW)**	VOLUME NO. : **II-B** SECTION : REV NO. **00** : DATE : **08.05.2020** SHEET : 1 OF 3

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TECHNICAL SPECIFICATION

FOR
AGITATOR

(ELECTRICAL PORTION)

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 **AGITATOR.**

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.

4.0 List of enclosures :

a) Electrical scope between BHEL & vendor

b) Specification for Motors

c) Specification for cable lugs and glands

d) Quality plan for motors

e) Electrical Load data format

f) BHEL cable listing format

REV: 0 DATE: **08.05.2020**

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)

PACKAGE: AGITATOR (Supply Package)

PROJECT: Ramagundam (FGD) STPP, Stage-I & II (3x200MW + 3x500

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
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. 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

TECHNICAL REQUIREMENTS

MOTORS

1.00.00 GENERAL REQUIREMENTS

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.

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.

1.03.00 Contactor shall provide fully compatible electrical system, equipment's, accessories and services.

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.

1.05.00 Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.

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.

1.07.00 Degree of Protection

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

2.00.00 CODES AND STANDARDS

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

	TECHNICAL REQUIREMENTS
3.00.00	**TYPE**
3.01.00	**AC Motors:** 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** (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.
6.00.00	**OPERATIONAL REQUIREMENTS**
6.01.00	**Starting Time**

	TECHNICAL REQUIREMENTS
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**
	(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 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

	TECHNICAL REQUIREMENTS
	(a) Fuel oil area : Group – IIB (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)
7.03.00	Winding and Insulation (a) Type : Non-hygroscopic, oil resistant, flame resistant (b) Starting duty : Two hot starts in succession, with motor initially at normal running temperature. (c) 11kV, 6.6 KV & 3.3 kV AC motors : Thermal class 155 (F) insulation. The winding insulation process shall be total Vacuum Presure Impregnated i.e resin poor method. The lightning Impulse & interturn insulation surge withstand level shall be as per IEC-60034 part-15. (d) 240VAC, 415V AC & 220V DC motors : Thermal Class (B) or better
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.
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

	TECHNICAL REQUIREMENTS
	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 the type test. The type test procedure shall clearly specify the test set–up, instruments to be used, procedure, acceptance norms, recording of different

	TECHNICAL REQUIREMENTS
	parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.
10.01.03	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 waival 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.
10.01.04	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.
10.01.05	**LIST OF TYPE TESTS TO BE CONDUCTED** **The following type tests shall be conducted on each type and rating of HT motor** (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.

	TECHNICAL REQUIREMENTS
10.01.06	**LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED** The following type test reports shall be submitted for each type and rating of HT motor (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	**LT Motors**
10.02.01	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 *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.
10.02.02	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.
10.02.03	**LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED** **The following type test reports shall be submitted for each type and rating of LT motor of above 100 KW only** 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

	TECHNICAL REQUIREMENTS
	6. Momentary excess torque test. 7. High voltage test 8. Test for vibration severity of motor. 9. Test for noise levels of motor(Shall be limited as per clause no 7.06.00 of this section) 10. Test for degree of protection and 11. Overspeed test. 12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1
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.

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

Cable glands

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.

Cable lugs/ferrules

Cable lugs/ferrules for power cables shall be tinned copper solderless crimping type suitable for aluminium compacted conductor cables. Cable lugs and ferrules for control cables shall be tinned copper type. The cable lugs for control cables shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipments. Cable lugs and ferrule shall conform to DIN standards

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-Q-006, REV-02	DATE: 17.04.2020
		PROJECT:		PO NO.:	DATE:
		ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))	SYSTEM:	SECTION: II	SHEET 1 of 2

S. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY **			REMARKS
1	2	3	4	5	6		7	8	9					
					M	C/ N				D	M	C	N	
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	-	MFG. SPEC.	MFG. SPEC.	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	VISUAL	100%	-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	LOG BOOK		P	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	-	MFG.SPEC./	MFG.SPEC.	LOG BOOK		P	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	-	MFG. SPEC/ APPROVED DATASHEET	MFG. SPEC/ APPROVED DATASHEET	LOG BOOK	✓	P	V	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST	MA	VISUAL	100%	-	IS-325 / IS-12615/ APPROVED DATA SHEET	IS-325 / IS-12615/ APPROVED DATA SHEET	TEST/ INSPN. REPORT	✓	P	V *	-	* NOTE -1
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	-	APPROVED DRG/ DATA SHEET	APPROVED DRG/ DATA SHEET	TEST/ INSPN. REPORT	✓	P	V *	-	* NOTE -1 & NOTE-2

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Reviewed by:		PRAVEEN DUTTA	Reviewed by:		RITESH KUMAR JAISWAL

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		3.NAMEPLATE DETAILS	MA	VISUAL	100%	-	IS-325 / IS-12615 / APPROVED DATA SHEET	SAME AS COL. 7	TEST/ INSPN. REPORT	✓	P	V	-	
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MFG. STANDARD / (#)	AS PER MFG. STANDARD / (#).	INSPC. REPORT	✓	P	W	-	(#) REFER NOTE-8

NOTES:
1. Routine tests on 100% motors shall be done by the vendor. However, BHEL/ Customer shall witness routine tests on random samples. The sampling plan shall be mutually agreed upon.
2. For exhaust/ventilation fan motors of rating up to 1.5 KW, only routine test certificates shall be furnished for scrutiny.
3. In case test certificates for these tests on similar type, size and design of motor from independent laboratory are available, the same is valid for 5 years.
4. BHEL reserves the right to perform repeat test, if required.
5. After packing and prior to issue MDCC, photographs of items to be despatched shall be sent to BHEL for review.
6. In case of any changes in QP commented by customer at contract stage, same shall be carried out by bidder without any implication to BHEL/ Customer.
7. Project specific QP to be developed based on customer requirement.
8. For export job, BHEL technical specification for seaworthy packing to be followed.
9. Packing shall be suitable for storage at site in tropical climate conditions.
10. Latest revision/ year of issue of all the standards (IS/ ASME/ IEC etc.) indicated in QP shall be referred.

LEGENDS:
*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
** **M**: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, B: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **C**: CUSTOMER,
P: PERFORM, **W**: WITNESS, **V:** VERIFICATION, AS APPROPRIATE
MA: MAJOR, **MI**: MINOR, **CR:** CRITICAL
D: DOCUMENTATION

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		CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04	
		PROJECT:		PO NO.:	
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 1 OF 9

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
1.0	RAW MATERIAL & BOUGHT OUT CONTROL													
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	LOG BOOK		P	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	SAMPLE	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	TEST REPORT		P/V	-		
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%	-		FREE FROM CRACKS, UN-EVENNESS ETC.	TEST REPORT		P	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	TC		P/V	-	-	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%	-	MANUFACTURER'S DRG./SPEC	FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK		P/V	-		
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	TC		P/V	-		HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG.	MANUFACTURER'S DRG.	LOG BOOK		P/V	-		
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	LOG BOOK		P/V	-		

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Reviewed by:		PRAVEEN DUTTA	Reviewed by:		R K JAISWAL

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	CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04	
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	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 2 OF 9

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S DRG./ STD.	TC		P/V	-		
		3. DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S DRG.	LOG BOOK		P/V	-		
		4.INTERNAL FLAWS	CR	ULTRASONIC TEST	100%	-	ASTM-A388	MANUFACTURER'S STD.	INSPECTION REPORT	✔	P/W	V	-	FOR DIA OF 55 MM & ABOVE
1.6	SPACE HEATERS, CONNEC-TORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	100%	-	MANUFACTURER'S DRG./STD.	MANUFACTURER'S DRG./STD.	INSPECTION REPORT		P/V	-	-	
		2. PHYSICAL COND.	MA	VISUAL	100%	-	MANUFACTURER'S DRG./STD.	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	INSPECTION REPORT		P/V	-	-	
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG./ STD	MANUFACTURER'S DRG. / STD.	INSPECTION REPORT		P/V	-	-	
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-	MANUFACTURER'S DRG./ STD	MANUFACTURER'S DRG. / STD.	TEST REPORT		P/V	-	-	

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Reviewed by:		PRAVEEN DUTTA	Reviewed by:		R K JAISWAL

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Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC.	MA	VISUAL	100%	-	-	NO VISUAL DEFECTS	TEST REPORT		P/V	-	-	
		2.DIMENSION(BORE DIA, WALL THICKNESS, BDV AS RECEIVED, BDV AFTER FOLDING AT 180°	MA	TEST	SAMPLE	-	MANUFACTURER'S STD.	MANUFACTURER'S STD.	LOG BOOK AND OR SUPPLIER'S TC		P/V	-	-	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND.	MA	VISUAL	100%	-	-	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK		P	-	-	
		2.DIMENSIONS INCLUDING BURS HEIGHT	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG. .	MANUFACTURER'S DRG.	LOG BOOK		P/V	-	-	
		3. ACCEPTANCE TESTS	MA	ELECT. & MECH TESTS	SAMPLE	-	MANUFACTURER'S DRG./ STD.	MANUFACTURER'S DRG./ STD.	TC		P/V	-	-	
1.9	CONDUCTORS	1. SURFACE FINISH	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		*P/V	-	-	* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY
		2.ELECT. PROP. & MECH. PROP	MA	ELECT. & MECH.TEST	SAMPLES	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S / SPEC.	TC & VENDOR'S TEST REPORTS		P/V	-	-	

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		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V)) / SYSTEM:	SECTION: II	SHEET 4 OF 9

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLES	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S / SPEC.	LOG BOOK LOG BOOK		P/V	-	-	
1.10	BEARINGS	1.MAKE & TYPE	MA	VISUAL	100%	-	MANUFACTURER'S DRG./ APPROVED DATASHEET	MANUFACTURER'S DRG./ APPROVED DATASHEET			P/V	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	APPROVED DATASHEET	APPROVED DATASHEET/ BEARING MANUF'S CATALOGUES	LOG BOOK		P/V	-	-	
		3.SURFACE FINISH	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P/V	-	-	
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-	
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	SAMPLE	-	MANUFACTURER'S STD./ APPROVED DATASHEET	MANUFACTURER'S STD./ APPROVED DATASHEET	LOG BOOK		P/V	-	-	
		4.HV/IR	MA	-DO-	100%	-	MANUFACTURER'S STD./ APPROVED DATASHEET	MANUFACTURER'S STD./ APPROVED DATASHEET	LOG BOOK		P/V	-	-	
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	-	MANUFACTURER'S DRG/SPECS	MANUFACTURER'S DRG./ SPECS.	LOG BOOK		P	-	-	
		2.SURFACE COND.	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-	

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Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY		
1	2	3	4	5	6		7	8	9	*	**		
					M	C/N				D	M	C	N
2.0	IN PROCESS												
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-	MANUFACTURER'S DRG	GOOD FINISH	LOG BOOK		P/W	-	-
		2.DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-	-DO-	GOOD FINISH	LOG BOOK		P	-	-
		2.DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-
		3.SHAFT SURFACE FLOWS	MA	PT	100%	-	MANUFACTURER'S STD./ ASTM-E165	MANUFACTURER'S STD./ APPROVED DATASHEET.	LOG BOOK	✔	P	V	-
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-
		3.SHADE	MA	VISUAL	SAMPLE	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	SAMPLE	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-

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Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S STD.	MANUFACTURER'S STD.	LOG BOOK		P	-	-	
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-	MANUFACTURER'S STD.	MANUFACTURER'S STD.	LOG BOOK		P	-	-	
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		2.CLEANLINESS	CR	VISUAL	100%	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	100%	-	IS-325//IS-12615/IEC-60034 PART-1	IS-325//IS-12615/IEC-60034 PART-1	TEST/INSPC. REPORT	✔	P	V	-	
		4.RESISTANCE	CR	ELECT. TEST	100%	-	IS-325//IS-12615/IEC-60034 PART-1	IS-325//IS-12615/IEC-60034 PART-1	TEST/INSPC. REPORT	✔	P	V	-	
		5.INTERTURN INSULATION	CR	ELECT. TEST	100%	-	IS-325//IS-12615/IEC-60034 PART-1	IS-325//IS-12615/IEC-60034 PART-1	TEST/INSPC. REPORT		P	-	-	
2.6	IMPREGNATION	1.VISCOSCITY	MA	PHY. TEST	AT STARTING	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK		P	-	-	
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK		P	-	-	
		3.NO. OF DIPS	MA	PROCESS CHECK	CONTINUOUS	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK	✔	P	V	-	THREE DIPS TO BE GIVEN

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	CUSTOMER :		QP NO.: PE-QP-099-Q-007, REV-04	
	PROJECT:		PO NO.:	
	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 7 OF 9

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
		4.DURATION	MA	PROCESS CHECK	CONTINUOUS	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK	✔	P	V	-	
2.7	COMPLETE STATOR ASSEMBLY	1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK		P	-	-	
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS	CR	VISUAL	100%	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK		P	-	-	
		2.SOUNDNESS	CR	MALLET TEST & UT	100%	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	TEST/INSPC. REPORT	✔	P	V	-	
		3.HV	MA	ELECT. TEST	100%	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	TEST/INSPC. REPORT	✔	P	V	-	
2.9	COMPLETE ROTOR ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	100%	-	MANUFACTURER'S SPEC./ ISO 1940	MANUFACTURER'S DWG.	LOG BOOK		P	-	-	
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	TEST/INSPC. REPORT	✔	P	V	-	
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK		P	-	-	
		2.WORKMANSHIP	MA	VISUAL	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK		P	-	-	
		3.AXIAL PLAY	MA	MEAS.	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK	✔	P	V	-	
		4.DIMENSIONS	MA	MEAS.	100%	-	MANUFACTURER'S DRG./ MANUFACTURER'S SPEC.	MANUFACTURER'S DRG./ MANUFACTURER'S SPEC.	LOG BOOK		P	-	-	
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK		P	-	-	
		6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK	✔	P	V	-	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:		PRAVEEN DUTTA	Reviewed by:		R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

बीएचईएल BHEL	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN	SPEC. NO :	DATE:17.04.2020
		CUSTOMER :	QP NO.: PE-QP-999-Q-007, REV-04	
		PROJECT:	PO NO.:	
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V)) / SYSTEM:	SECTION: II	SHEET 8 OF 9

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS	MA	ELECT.TEST	1/TYPE/SIZE	1/TYPE/SIZE	IS-325//IS-12615/APPROVED DATASHEET	IS-325/IS-12615/APPROVED DATASHEET	TEST REPORT	✔	P	W*	-	* NOTE - 1
		2.ROUTINE TESTS INCLUDING SPECIAL TEST	MA	ELECT.TEST	100%	-	IS-325//IS-12615/APPROVED DATASHEET	IS-325/IS-12615/APPROVED DATASHEET	TEST REPORT	✔	P	V$	-	$ NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	ELECT.TEST	100%	-	IS: 12075 / IEC 60034-14 & IS-12065	IS: 12075 / IEC 60034-14 & IS-12065	TEST REPORT	✔	P	V$	-	$ NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET &	TEST/INSPC. REPORT	✔	P	W	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	-	IEC 60034-5/IS-12615	APPROVED DATASHEET	TC	✔	P	V	-	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	ELECT. & MECH. TEST	100%	-	IS-325//IS-12615/IEC-60034 PART-1/IS: 12802	IS-325/IS-12615/IEC-60034 PART-1/IS: 12802	TC	✔	P	V$	-	$ NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	ELECT. & MECH. TEST	100%	-	IS-325//IS-12615/IEC-60034 PART-1	IS-325/IS-12615/IEC-60034 PART-1	TC	✔	P	V$	-	$ NOTE - 2
		8. NAME PLATE DETAILS	MA	VISUAL	100%	-	IS-325//IS-12615& DATA SHEET	IS-325//IS-12615 & DATA SHEET	TEST/INSPC. REPORT	✔	P	V$	-	$ NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	-	IS 2148 / IEC 60079-1	IS 2148 / IEC 60079-1	TC	✔	P	V	-	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	SAMPLE	APPROVED DATASHEET	APPROVED DATASHEET	TC	✔	P	WS	-	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY $ NOTE - 2

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:		PRAVEEN DUTTA	Reviewed by:		R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

बी एच ई एल BHEL	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN	SPEC. NO :	DATE:17.04.2020
		CUSTOMER :	QP NO.: PE-QP-999-Q-007, REV-04	
		PROJECT:	PO NO.:	
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V)) / SYSTEM:	SECTION: II	SHEET 9 OF 9

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MANUFACT. STANDARD / (#)	AS PER MANUFACT. STANDARD / (#)	INSPC. REPORT	✔	P	W	-	(#): REFER NOTE-8

NOTES:

1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED.

2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL/CUSTOMER SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON.

3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THE SAME IS VALID FOR 5 YEARS.

4 BHEL RESERVES THE RIGHT TO PERFORM REPEAT TEST, IF REQUIRED.

5 AFTER PACKING AND PRIOR TO ISSUE MDCC, PHOTOGRAPHS OF ITEMS TO BE DESPATCHED SHALL BE SENT TO BHEL PURCHASE GROUP FOR REVIEW.

6 IN CASE , ANY CHANGES IN QP COMMENTED BY CUSTOMER AT CONTRACT STAGE SHALL BE CARRIED OUT BY BIDDER WITHOUT ANY IMPLICATION TO BHEL/ CUSTOMER.

7 PROJECT SPECIFIC QP TO BE DEVELOPED BASED ON CUSTOMER REQUIREMENT.

8 FOR EXPORT JOB, BHEL TECHNICAL SPECIFICATION FOR SEAWORTHY PACKING TO BE FOLLOWED.

9 PACKING SHALL BE SUITABLE FOR STORAGE AT SITE IN TROPICAL CLIMATE CONDITIONS.

10 LATEST REVISION/ YEAR OF ISSUE OF ALL THE STANDARDS (IS/ ASME/ IEC ETC.) INDICATED IN QP SHALL BE REFERRED.

LEGENDS:

*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,

** **M**: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, B: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **C**: CUSTOMER,

P: PERFORM, **W**: WITNESS, **V**: VERIFICATION, AS APPROPRIATE

MA: MAJOR, **MI**: MINOR, **CR**: CRITICAL

D: DOCUMENT

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:		PRAVEEN DUTTA	Reviewed by:		R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

ANNEXURE-III

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	NOs				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

NOTES:
1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)/ CUSTOMER
2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V
: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)

LOAD DATA (ELECTRICAL)	JOB NO.		ORIGINATING AGENCY		PEM (ELECTRICAL)	
	PROJECT TITLE		NAME		DATA FILLED UP ON	
	SYSTEM	AGITATOR	SIGN.		DATA ENTERED ON	
	DEPTT. / SECTION	MAUX	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE	

27.DE.28

CABLE ID	FROM	TO	PURPOSE	CABLE SCOPE (BHEL PEM/VENDOR)	REMARKS	CABLE SIZE	PATH CABLE NO

	TITLE: (3x200+3x500) MW RAMAGUNDAM FGD TECHNICAL SPECIFICATIONS FOR AGITATORS OF FGD SLURRY TANKS	SPECIFICATION No: PE-TS-467-571-18000-A002	
		SECTION-I, SUB-SECTION-D	
		REV. 00	DATE: OCT 2021
		SHEET : 1 OF 1	

ANNEXURE-I

LIST OF MAKES OF SUB-VENDOR ITEMS

Sl.no.	Item	Category of Inspection	Sub-vendor	Place	Remarks
1.	PAINT	III	ASIAN PAINT		
		III	BERGER		
		III	KANSAI NEROLAC		
		III	JOTUN		
		III	SHALIMAR		
		III	JENSON & NICHOLSON (I) LTD		
		III	CDC CARBOLINE (I) LTD.		
		III	ADDISON PAINTS LTD		
		III	GRAND POLYCOAT		
NOTES: INSPECTION CATEGORIZATION					
CAT I: INSPECTION BY OWNER, BHEL/BHEL NOMINATED TPIA & VENDOR. MDCC WILL BE ISSUED BASED ON INSPECTION REPORT IN LINE ITH APPROVED QAP.					
CAT II: INSPECTION BY BHEL/BHEL NOMINATED TPIA & VENDOR. MDCC WILL BE ISSUED BASED ON INSPECTION REPORT IN LINE ITH APPROVED QAP.					
CAT III: MDCC WILL BE ISSUSED BASED COC & MTC ISSUSD BY VENDOR AND VERIFICATION BY BHEL / OWNER IN LINE WITH APPROVED QAP/CHECK LIST					

एनटीपीसी NTPC	PROJECT : PACAKGE : EPC Sub Package: MOTORS & VVF Drive Panels CONTRACTOR : M/S BHEL CONT. NO. CS-9585-401-2	LIST OF ITEMS REQUIRING QP APPROVAL & ACCEPTABLE VENDOR ; CONTRACTOR-M/S BHEL	REF NO : 9585-001-QOE-R-01 REVISION NO. 00 DATE 20th April 2017

Sl. No.	ITEM	QP / INS CAT.	QP No:- 9585-001-QVE-	QP SUB. SCH.	QP APPL SCHE DULE	SUB-SUPPLIERS	PLACE	SUB-SUPPLIER APPL STATUS AS PER NTPC	SC APPL SCHE DULE	REMARKS
1)	L T (415 V) Motors	Refer Note 1				ABB	FARIDABAD	A		UPTO 55KW
						ABB	BANGALORE	A		55KW – 200KW
						BHARAT BIJLEE	MUMBAI	A		RQP, FOR FLAME PROOF ALSO
						CGL	AHMEDNAGAR	A		FOR FLAME PROOF ALSO
						JYOTI	BARODA	A		
						KEC	BANGALORE	A		FOR FLAMEVPROOF ALSO
						KEC	HUBLI	A		UPTO 90KW; FOR FLAME PROOF ALSO
						LHP	SOLAPUR	A		UPTO 200KW
						MARATHON	KOLKATA	A		FOR FLAME PROOF ALSO
						NGEF	BANGALORE	A		UPTO 15KW
						SIEMENS	MUMBAI	A		
2)	HT MOTOR	1				BHEL	BHOPAL	A		
3)	DC MOTOR	Refer Note 1				BHEL	HARIDWAR	A		
						CGL	AHMEDNAGAR	A		
						KEC	BANGLORE/ HUBLI	DR		
4)	VARIABLE FREQUENCY DRIVES PANELS	1				L&T-YASHKAWA	INDIA	A		
						DANFOSS	CHENNAI	A		
						SCHNEIDER	NASHIK	A		
						ROCKWELL ALLEN BRADLEY	DELHI-SHAHIBABAD	A		DR for HT
						ABB	BANGALORE	A		
						SIEMENS	NASHIK	A		
						GE		DR		

Bharat Heavy Electricals Limited PS-MKTG Delhi

Pariyojna Vikas Utpadan Nigam Limited C & M Deptt. Distt-Ramgarh(Jhark.)

For BPC

एनटीपीसी NTPC	PROJECT : PACAKGE : EPC Sub Package: MOTORS & VVF Drive Panels CONTRACTOR : M/S BHEL CONT. NO. CS-9585-001-2	LIST OF ITEMS REQUIRING QP APPROVAL & ACCEPTABLE VENDOR ; CONTRACTOR-M/S BHEL	REF NO : 9585-001-QOE-R-01 REVISION NO. 00 DATE 20th April 2017

SI. No.	ITEM	QP / INS CAT.	QP No:- 9585-001-QVE-	QP SUB. SCH.	QP APPL SCHE DULE	SUB-SUPPLIERS	PLACE	SUB-SUPPLIER APPL STATUS AS PER NTPC	SC APPL SCHE DULE	REMARKS
						HITACHI-HIREL	GANDHINAGAR/ SANAND	DR		
						INGETEAM TECHNOLOGIES	SPAIN	DR		
						NIDEC(ANSALDO)	ITALY	DR		
						FUJI ELECTRIC SYSTEMS	JAPAN	DR		
						TMEIC	BANGALORE	DR		
						L&T	MUMBAI	DR		

NOTE 1 : FOR LT MOTORS

a) Less than 30 KW

Acceptance of Motor less than 30 KW is based on COC of the manufacturer & the contractor confirming as follows:
It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage & frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise, distance between centre of stud & gland plate and tested in accordance with approved drawing /data sheets.

b) 30 KW -50KW

Acceptance of Motor rating between 30 KW & 50 KW is based on NTPC review of Routine Test inspection report as per IS 325 witnessed by main contractor along with COC of the manufacturer & the contractor confirming as follows:
It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage & frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise, distance between centre of stud & gland plate, space heater and tested in accordance with approved drawing /data sheets.

c) Above 50 KW as per NTPC approved quality plan

Approval Conditions attached to above vendors-as applicable shall prevail.

General Notes:

1) Vendor list & category of the mandatory spares shall be as mentioned above.
2) For item not appearing in the above list, main contractor to approach NTPC for acceptable vendors & inspection categorization of the same.
3) NTPC Approval conditions to above identified vendors shall be adhered to. Vendor's approval conditions will be informed on specific request of Main Contractor.

NTPC

Bharat Heavy Electricals Limited PS-MKTG Delhi

(JATIN GAHLAWAT)
BHEL

Bharat Heavy Electricals Limited (Bhel) Vidyut Utpadan Sanyant Parel Distt-Ramgarh (Jharkhand) C&M Deptt.

170

NTPC

PROJECT : P
PACKAGE : EPC (FGD) Package
MAIN CONTRACTOR : M/s BHEL
CONTRACT NO : CS-8585-0)1-2

LIST OF ITEMS REQUIRING QP APPROVAL & ACCEPTABLE VENDOR AS APPROVED BY

REF. NO :
REVISION NO : 00
DATE : 16-05-17

No.	Major Equipment	QP Inspection Criteria	QP No.	QP Submission SCH	QP Approval SCH	Proposed Sub Supplier	Place	SS Approval Status	SS Detail Sub. SCH	SS Approval SCH	Remark
23	Hydro Cyclone	I				FL Smidth	Chennai	DR			
		I				Weir Minerals	Bangalore	A			
		I				Multo Tech	S.Africa	A			
		I				McNally Bharat	Bangalore	DR			
24	Rubber Lining of Pipes	I				Jasmine Polymertech	Taloja	A			
		I				CORI Engineers	Chennai	A			
		I				Western Rubber	Mumbai	A			
		I				Eastomer Lining	Ambernath	A			
		I				Emkay Rubber	Mumbai	A			
		I				Rishi	Bahalgarh	A			
		I				Poly Rubber	Mumbai	A			
		I				Temsec Rubber	Kolkata	A			
		I				Presidency Rubber	Howrah	A			
		I				Arul Rubber Pvt.Ltd	Hosur	A			
		I				Industrial Moulders	Vadodara	A			
		I				MILL Industries	Chennai	DR			
		I				Lebracs rubber	Pondicherry	DR			
25	FRP PIPE with fittings	III				Main contractor approved source		A		upto 3"	
26	Rubber Lining for Tank and absorber	III				ML Industries	Chennai	A			
		III				TIP TOP	Germany	A			
		III				Sealuer	Germany	A			
		III				Arul Rubber	Hosur	A			
		III				Temsec Rubber	Kolkata	A			
						Lebracs Rubber	Pondicherry	DR			
						CORI Engineers	Chennai	DR			
27	Ventilation Fans	I				Patel Air	Ahmedabad	A			
		I				Marathon Electric	Kolkata	A			
		I				Howden	Kolkata / Chennai	A			
		I				SK System	Sonepat	A			
		I				Andrew Yule	Kalyani	A			
		I									

Bharat Heavy Electricals Limited ★ PS-MKTG Delhi

Patratu Vidyut Utpadan Nigam Limited ★ Distt-Ramgarh (Jharkhand) ★ Q & M Deptt.

BHEL

एनटीपीसी NTPC	Project : I Package : EPC Contractor : BHEL, Hyderabad Contract No.:	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUBCONTRACTOR APPROVAL SUB SYSTEM: BFP, Drive Turbine, Heaters (HP, LP) Drain Cooler and Deaerator	Ref No.: 9585-001-02 Revision No.: 00 Date: 05.04.2017

SN	ITEM	QP/ INS-PN CAT *	QP No. xxxx-110	QP SUB-MISSION SCHEDULE	QP APPL SCHEDULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB-SCHEDULE	SC APPL SCHEDULE	REMARKS
		I				EDELSTAHLWERKE	GERMANY	A			
		I				GROEDITZ	GERMANY	DR			
		I				PILSON STEEL (VHS,SKODA)	CZECKSLOVAKIA	A			
		I				JCFC	JAPAN	A			
		I				JSC ENERGOMASH	UKRAIN	DR			
		I				JSW	JAPAN	A			
		I				KOBE STEEL	JAPAN	A			
		I				CRUIST FORGE	FRANCE	A			
33	PRECISION BLADE FORGINGS	I	QVM-Q-308			PETRO ROSA	GERMANY	A			
		I				FINE FORGE	HYDERABAD	A			
		I				C BLADE	ITALY	A			
		I				WUXI	CHINA	A			AS PER NTPC APPROVAL CONDITIONS
		I				AZAD ENGG	HYDERABAD	A			FOR MACHINING ONLY
34	BAR STOCK FOR BLADES	I	QVM-Q-308			WALZWERK EINSL	GERMANY	A			
		I				BOEHLER	AUSTRIA	A			
		I				BGH	GERMANY	A			
		I				BREITENFIELD	AUSTRALIA	A			
		I				STARWIRE	BALLABHGARH	A			
35	DRAWN PROFILE FOR GUIDE BLADES (DRIVE TURBINE)	I	QVM-Q-308			FIAV	ITALY	A			
		I				LEISTRITZ	GERMANY	A			
		I				BOEHLER	AUSTRIA	A			
36	GEAR BOX	I	QVM-Q-308			TRIVENI ENGG	MYSORE	A			
		I				FLENDER GRAFFENSTADEN	FRANCE	A			

Bharat Heavy Electricals Limited ★ PS-MKTG Delhi

Patratu Vidyut Utpadan Nigam Limited ★ Distt-Ramgarh (Jharkhand) ★ C & M Deptt.

ENGINEERING DIV / QAI-NTPC,NOIDA	Page 9 of 20	BHEL

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एनटीपीसी NTPC	Project : I Package : EPC Contractor : BHEL, Hyderabad Contract No.:	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUBCONTRACTOR APPROVAL SUB SYSTEM: BFP, Drive Turbine, Heaters (HP, LP) Drain Cooler and Deaerator	Ref No.: 9585-001-02 Revision No.: 00 Date: 05.04.2017

SN	ITEM	QP/ INS-PN CAT *	QP No. xxxx-110	QP SUB-MISSION SCHEDULE	QP APPL SCHEDULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB-SCHEDULE	SC APPL SCHEDULE	REMARKS
		I				LUFKIN	USA/FRANCE	A#			
		I				RENK TACKE GMBH	GERMANY	A#			
		I				WALCHANDNAGAR	PUNE	A#			
						WINENERGY	CHENNAI	DR			
37	DRIVE TURBINE	I	QVM-Q-308			BHEL	HYDERABAD	A			
38	CONNECTING COUPLING (GEAR TYPE)	I	QVM-Q-308			RENK TACKE GMBH	GERMANY	A			
	CONNECTING COUPLING (MEMBRANE)	I				LUFKIN	USA/FRANCE	A			
		I				FLENDER	GERMANY	A			
		I				WALCHANDNAGAR	WALCHANDNAGAR	A			
		I	QVM-Q-308			EUROFLEX LTD.,	HYDERABAD	A			
		I				JOHN CRANE	UK	A			
		I				AMERDRIVES	USA	A			
						RATHI TURBOFLEX	PUNE	A			
39	AUX. CONTROL VALVE BODY & COVER	I	QVM-Q-309			CFFP	HARDWAR	A			
		I				KOLHAPUR STEELS	KOLHAPUR	A			
		I				UP STEELS	MUJAFARNAGAR	A			
		I				STAR WIRES	BALLABGARH	A			
						PRAKASH SPECTRO	VIJAYAWADA	DR			
40	LUBE OIL CENTRIFUGAL PUMP	II	QVM-Q-310			KSB	PUNE	A			
		II				KIRLSOKAR EBARA	KIRLOSKARWADI	A			
		II				SULZER	MUMBAI	A			
41	LUBE OIL PUMP (SCREW PUMP)	II	QVM-Q-311			ALLWEILER	GERMANY	A			
		II				TUSHACO PUMP	DAMAN	A			
		II				LEISTRITZ	GERMANY	A			
		II				IMOPUMP	USA	A			
42	DISCONNECTING COUPLING	II	QVM-Q-312			AMER DRIVES	USA	A			
43	CENTRIFUGE	I	QVM-Q-313			ALFALAVAL	PUNE/SWEDEN	A			

Bharat Heavy Electricals Limited FS-MKTG Delhi

Patratu Vidyut Utpadan Nigam Limited Distt-Ramgarh (Jharkhand) C & M Deptt.

ANNEXURE-A

- The list of all bought out items like gearbox, coupling, bearings etc. with makes and country of origin and contact details of the manufacturers to be mentioned along with offer to be submitted in the format attached in section II Annexure-6 as an information to BHEL.

- Bidder has to submit the sub-vendor questionnaire (attached herewith) along with necessary credentials in case the proposed sub-vendor is not as per the list provided.

- Acceptance of makes shall be subject to BHEL/ End customer acceptance during the detailed engineering without cost and delivery implication to BHEL.

- The complete list will be necessarily submitted within one month of placement of LOI to ensure timely placement of order for BOIs. Bidder to assess the capability of their proposed sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them.

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CORPORATE QUALITY ASSURANCE
SUB-VENDOR QUESTIONNAIRE

i.	Item/Scope of Sub-contracting			
ii.	Address of the registered office	Details of Contact Person (Name, Designation, Mobile, Email)		
iii.	Name and Address of the proposed Sub-vendor's works where item is being manufactured	Details of Contact Person: (Name, Designation, Mobile, Email)		
iv.	Annual Production Capacity for proposed item/scope of sub-contracting			
v.	Annual production for last 3 years for proposed item/scope of sub-contracting			
vi.	**Details of proposed works**			
1.	Year of establishment of present works			
2.	Year of commencement of manufacturing at above works			
3.	Details of change in Works address in past (if any)			
4.	Total Area			
	Covered Area			
5.	Factory Registration Certificate	Details attached at Annexure – F2.1		
6.	Design/ Research & development set-up (No. of manpower, their qualification, machines & tools employed etc.)	Applicable / Not applicable if manufacturing is as per Main Contractor/purchaser design) Details attached at Annexure – F2.2 (if applicable)		
7.	Overall organization Chart with Manpower Details (Design/Manufacturing/Quality etc)	Details attached at Annexure – F2.3		
8.	After sales service set up in India, in case of foreign sub-vendor (Location, Contact Person, Contact details etc.)	Applicable / Not applicable Details attached at Annexure – F2.4		
9.	Manufacturing process execution plan with flow chart indicating various stages of manufacturing from raw material to finished product including outsourced process, if any	Details attached at Annexure – F2.5		

एनटीपीसी NTPC

CORPORATE QUALITY ASSURANCE
SUB-VENDOR QUESTIONNAIRE

10.	**Quality Control exercised during receipt of raw material/BOI, in-process , Final Testing, packing**	**Details attached at Annexure – F2.6**
11.	**Manufacturing facilities** **(List of machines, special process facilities, material handling etc.)**	**Details attached at Annexure – F2.7**
12.	**Testing facilities** **(List of testing equipment)**	**Details attached at Annexure – F2.8**
13.	**If manufacturing process involves fabrication then-** **List of qualified Welders** **List of qualified NDT personnel with area of specialization**	**Applicable / Not applicable** **Details attached at Annexure – F2.9** **(if applicable)**
14.	**List of out-sourced manufacturing processes with Sub-Vendors' names & addresses**	**Applicable / Not applicable** **Details attached at Annexure. –F2.10** **(if applicable)**
15.	**Supply reference list including recent supplies**	**Details attached at Annexure – F2.11** **(as per format given below)**

Project/ package	*Customer Name*	*Supplied Item (Type/Rating/Model /Capacity/Size etc)*	*PO ref no/date*	*Supplied Quantity*	*Date of Supply*

16.	**Product satisfactory performance feedback letter/certificates/End User Feedback**	**Attached at annexure - F2.12**
17.	**Summary of Type Test Report (Type Test Details, Report No, Agency, Date of testing) for the proposed product (similar or higher rating)** **Note:- Reports need not to be submitted**	**Applicable / Not applicable** **Details attached at Annexure – F2.13** **(if applicable)**
18.	**Statutory / mandatory certification for the proposed product**	**Applicable / Not applicable** **Details attached at Annexure – F2.14** **(if applicable)**
19.	**Copy of ISO 9001 certificate** **(if available)**	**Attached at Annexure – F2.15**
20.	**Product technical catalogues for proposed item (if available)**	**Details attached at Annexure – F2.16**

Name:		**Desig:**		**Sign:**		**Date:**	

Company's Seal/Stamp:-

	TITLE: (3x200+3x500) MW RAMAGUNDAM FGD TECHNICAL SPECIFICATIONS FOR AGITATORS OF FGD SLURRY TANKS	SPECIFICATION No: PE-TS-467-571-18000-A002	
		SECTION-I Sub Section-D	
		REV. 00	DATE: OCT 2021
		SHEET : 1 OF 1	

ANNEXURE-II

MANDATORY SPARE LIST

TECHNICAL SPECIFICATION FOR AGITATOR (3x200+3x500) MW RAMAGUNDAM FGD		SPECIFICATION NO. :PE-TS-467-571-18000-A002
		ANNEXURE-II
Sl. No.	PARTICULARS	Unit /Quantity (Nos./SET/%)
1	AGITATORS	
1.1	AUXILIARY ABSORBENT TANK AGITATOR	
1	Impeller Assembly	1 no. of each type and size
2	Bearing Assembly	1 no. of each type and size
3	Motor	1 no. of each type
4	Belt and Pulley (If applicable)	1 no. of each type and size
5	Gear Box Assembly (If Applicable)	1 no. of each type and size
6	Agitator shaft assembly	1 no. of each type and size
7	Shaft Seal	1 no. of each type and size
8	Complete Agitator Assembly	1 no. of each type and size
1.2	LIMESTONE SLURRY STORAGE TANK AGITATORS	
1	Impeller Assembly	1 no. of each type
2	Bearing Assembly	1 no. of each type
3	Motor	1 no. of each type
4	Belt and Pulley (If applicable)	1 no. of each type
5	Gear Box Assembly (If Applicable)	1 no. of each type
6	Agitator shaft assembly	1 no. of each type and size
7	Complete Agitator Assembly	1 no. of each type and size
1.3	PRIMARY HYDRO-CYCLONE FEED TANK AGITATOR	
1	Impeller Assembly	1 no. of each type
2	Bearing Assembly	1 no. of each type
3	Motor	1 no. of each type
4	Belt and Pulley (If applicable)	1 no. of each type
5	Gear Box Assembly (If Applicable)	1 no. of each type
6	Agitator shaft assembly	1 no. of each type and size
7	Complete Agitator Assembly	1 no. of each type and size
1.4	SECONDARY HYDROCYCLONE FEED TANK AGITATOR	
1	Impeller Assembly	1 no. of each type
2	Bearing Assembly	1 no. of each type
3	Motor	1 no. of each type
4	Belt and Pulley (If applicable)	1 no. of each type
5	Gear Box Assembly (If Applicable)	1 no. of each type
6	Agitator shaft assembly	1 no. of each type and size

TECHNICAL SPECIFICATION FOR AGITATOR (3x200+3x500) MW RAMAGUNDAM FGD		SPECIFICATION NO. :PE-TS-467-571-18000-A002
		ANNEXURE-II
Sl. No.	**PARTICULARS**	**Unit /Quantity (Nos./SET/%)**
7	Complete Agitator Assembly	1 no. of each type and size
1.5	**FILTRATE WATER TANK AGITATOR**	
1	Impeller Assembly	1 no. of each type
2	Bearing Assembly	1 no. of each type
3	Motor	1 no. of each type
4	Belt and Pulley (If applicable)	1 no. of each type
5	Gear Box Assembly (If Applicable)	1 no. of each type
6	Agitator shaft assembly	1 no. of each type and size
7	Complete Agitator Assembly	1 no. of each type and size
1.6	**WASTE WATER TANK AGITATOR**	
1	Impeller Assembly	1 no. of each type
2	Bearing Assembly	1 no. of each type
3	Motor	1 no. of each type
4	Belt and Pulley (If applicable)	1 no. of each type
5	Gear Box Assembly (If Applicable)	1 no. of each type
6	Agitator shaft assembly	1 no. of each type and size
7	Complete Agitator Assembly	1 no. of each type and size
1.7	**AGITATOR FOR DRAIN PIT (FOR ABSORBER AREA,GYPSUM AREA AND LIMESTONE AREA)**	
1	Impeller Assembly	1 no. of each type and size
2	Bearing Assembly	1 no. of each type and size
3	Motor	1 no. of each type and size
4	Belt and Pulley (If applicable)	1 no. of each type and size
5	Gear Box Assembly (If Applicable)	1 no. of each type and size
6	Agitator shaft assembly	1 no. of each type and size
7	Complete Agitator Assembly	1 no. of each type and size

Note:

1)One set means 100% complete replacement of the particular component/equipment, as mentioned i.e., Set for the particular equipment, would include all components required to replace the item. For example, a set of bearing shall include all hardware normally required while replacing the bearings. It is further, intended that the assembly / sub-assembly which have different orientation (like left hand or right hand, top or bottom), different direction of rotation or mirror image positioning or any other reasons which result in maintaining two different sets of the spares to be used for the subject assembly / sub-assembly, these shall be considered as different types of assembly/sub-assembly.

2) Wherever the quantities have been indicated for each type, size, thickness, material, radius, range etc. these shall cover all the items supplied and installed.

TECHNICAL SPECIFICATION FOR AGITATOR (3x200+3x500) MW RAMAGUNDAM FGD		SPECIFICATION NO. :PE-TS-467-571-18000-A002
		ANNEXURE-II
Sl. No.	PARTICULARS	Unit /Quantity (Nos./SET/%)

3) In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed in the above list.

4) Any item which is quoted as “not applicable” in the above list and is found to be “applicable” at a later date shall be supplied by the bidder without any commercial implications. The Bidder shall note that if there in any change/ variation in equipment/ system during detail engineering which causes any change/ variation in the essential spares quantity, the same shall be supplied without any commercial implications. The price indicated for the mandatory spares shall be considered for the purpose of evaluation.

5) Mandatory spares shall not be dispatched before dispatch of corresponding main equipment. Pls. refer NIT for delivery schedule. The spares shall be treated and packed for a long storage under the climatic condition prevailing at site.

6) All spares supplied under this contract shall be strictly interchangeable with parts for which they are intended for replacements. These spares should include all mounted accessories like components, boards, add or items, fitting, connectors etc. and be complete in all respects so that the replacement of the main items by these spares does not require any additional item. The vendors must conform the pair to pair compatibility of each electrical spares modules with the modules supplied in the original package. All electronic modules should be pre-set and/or pre-programmed for ready use at site. Alternatively, suitable instruction sheet indicating the details of required PCB jumper position, BCD which is setting, EPROM/PROM listing etc should be packed along with each module. Also a caution mark sign should be put on all such module which needs pre-setting/pre-programming before putting them in to service. The spare shall be treated and properly packed for long term storage.

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

8) Set for the particular equipment, would include all components required to replace the item, for example a set of bearing shall include all hardware normally required while replacing the bearings. It is further intended that the assembly / sub-assembly which have different orientation (like left hand or right hand, top or bottom), different direction of rotation or mirror image positioning or any other reasons which result in maintaining two different sets of the spares to be used for the subject assembly / sub-assembly, these shall be considered as different types of assembly/sub-assembly.

9)All the spares shall be manufactured along with the main equipment components as a continuous operation as per same specification and quality plan.

10)The Contractor shall warrant that all spares supplied will be new and in accordance with the Contract Documents and will be free from defects in design, material and workmanship.

11) Any cell left blank in the unpriced schedule shall be teated as "Quoted"

12) Bidder to provide mandatory spares as asked above for each type of tank separately ,even in case type & size of tank of agitator is similar.

	TITLE: (3x200+3x500) MW RAMAGUNDAM FGD TECHNICAL SPECIFICATIONS FOR AGITATORS OF FGD SLURRY TANKS	SPECIFICATION No: PE-TS-467-571-18000-A002	
		SECTION-I Sub Section-D	
		REV. 00	DATE: OCT 2021
		SHEET : 1 OF 1	

ANNEXURE-III

INPUT DRAWINGS (GAD/SKETCH OF TANKS)

Tank Sizing Basis(below 10.0 m dia):

Tank size is decided as per the following

LL – Pump LL level m

L – LL + 0.2 m

H - Effective height m

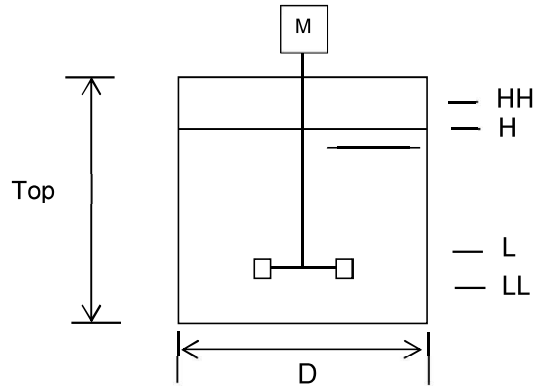
HH - H + 0.2 m

Top - HH + 0.5 m

Effective volume = 3.14 / 4 x Φ ^ 2 x (H-L)

Hold volume = 3.14 / 4 x Φ ^ 2 x (HH)

H/D ratio = ~1.2 (Max)



Tank Sizing basis (Above 10.0 m dia):

Tank size is decided as per the following

LL – Pump LL level m

L – LL + 0.2 m

H - Effective height m

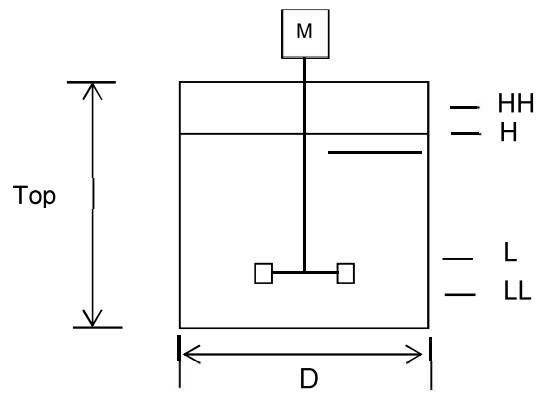
HH - H + 0.2 m

Top - HH + 0.8 m

Effective volume = 3.14 / 4 x Φ ^ 2 x (H)

Hold volume = 3.14 / 4 x Φ ^ 2 x (HH)

H/D ratio = ~1.0 (Max)

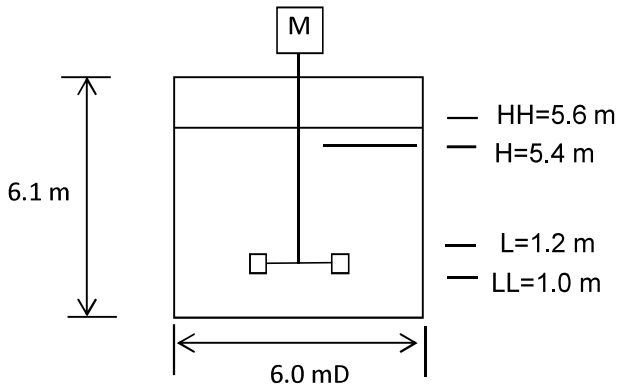


Gas condition for Tank Sizing:

S.No	Gas Condition	Feature
1	VWO Worst coal	FGD Design Point

Tank Sizing:

S. No	Item No	Service	Design Spec	Process Parameter	Design Basis
1	00HTM 03 BB001	Filtrate water Tank	6000 mm D X 6100 mmH Quantity = 1 no. (Common for combine absorber (3 X200 MW) and as well as for all 500 MW units.)	Process Capacity	211.8m3/h (48.15 X 3 + 67.35) (Design point- 3X500MW- Stream No: <402> x 3 Units + Design point 3X200MW - Stream No: <402>)
				Retention Time	0.5 Hr
				Required volume	211.8 m3/h x 0.5 hr =105.9 m3



Tank Level is designated as follows

Top	6.1
HH	5.6
H	5.4
L	1.2*
LL	1.0*

Circular Tank

Effective volume

= 6.0 m Φ ^ 2 / 4 x π x (5.4-1.2) m

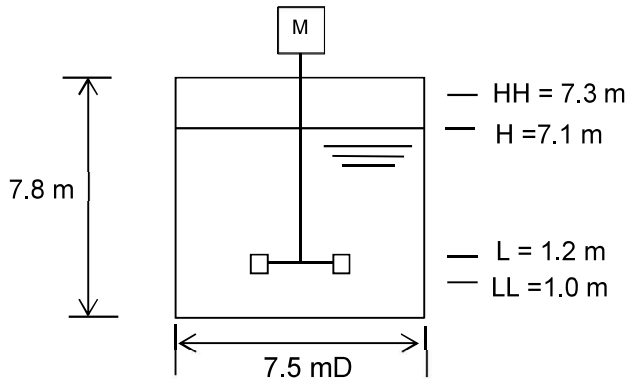
= 118.75 m3>105.91 m3

Hold Volume

= 6.0 m Φ ^ 2 / 4 x π x 5.6 m = 158.3m3

*L and LL level is finalized by vendor's information of filtrate water pump and agitator.

S.No	Item No	Service	Design Spec	Process Parameter	Design Basis
2	00HTM00 BB001	Primary Hydro cyclone feed Tank	7500 mm D X 7800 mmH Quantity = 1 no. (Common for combine absorber (3 X200 MW) and as well as for all 500 MW units.)	Process Capacity	235.45 m3/h (53.94 X 3+ 73.63) (Design point- 3X500MW- Stream No: <201> x 3 Units + Design point 3X200MW - Stream No: <201>)
				Retention Time	1 Hour
				Required volume	235.45 m3/h x 1 hr = 235.45 m3



Tank Level is designated as follows

Top	7.8
HH	7.3
H	7.1
L	1.2*
LL	1.0*

<u>Circular Tank</u>

Effective volume

= 7.5 m Φ ^ 2 / 4 x π x (7.1-1.2) m

= 260.65 m3 > 235.45 m3

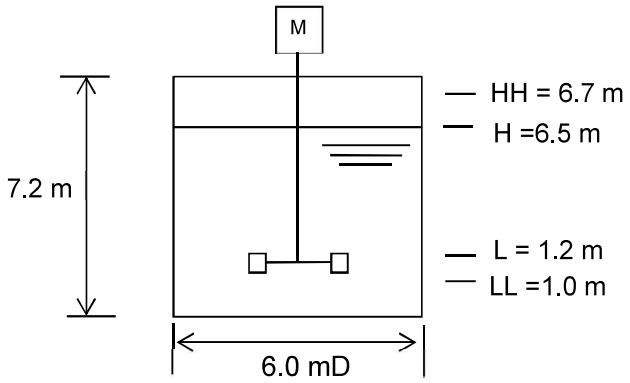
Hold Volume

= 7.5 m Φ ^ 2 / 4 x π x 7.3 m

=322.50 m3

*L and LL level is finalized by vendor's information of Waste water hydro cyclone feed pump and agitator.

S.No	Item No	Service	Design Spec	Process Parameter	Design Basis
3	00HTM04 BB001	Secondary Hydro cyclone feed Tank	6000 mm D X 7200mmH- Quantity = 1 no. (Common for combine absorber (3 X200 MW) and as well as for all 500 MW units.)	Process Capacity	136.03 m3/h (31.17 X3 + 42.52) (Design point- 3X500MW- Stream No: <202> x 3 Units + Design point 3X200MW - Stream No: <202>)
				Retention Time	1 Hours
				Required volume	136.03 m3/h x 1 hr = 136.03 m3



Tank Level is designated as follows

Top	7.2
HH	6.7
H	6.5
L	1.2*
LL	1.0*

<u>Circular Tank</u>

Effective volume

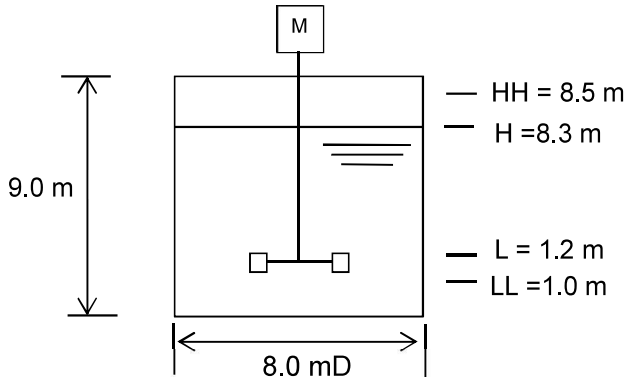
= 6.0 m Φ ^ 2 / 4 x π x (6.5-1.2) m = 149.85 m3>136.03 m3

Hold Volume

= 6.0 m Φ ^ 2 / 4 x π x 6.7 m =189.4 m3

*L and LL level is finalized by vendor's information of Waste water hydro cyclone feed pump and agitator.

S. No	Item No	Service	Design Spec	Process Parameter	Design Basis
4	00HTM 05BB0 01	Waste water storage Tank	8000 mmD X 9000 mmH- Quantity = 1 no. (Common for combine absorber (3 X200 MW) and as well as for all 500 MW units.)	Process Capacity	41.16 m3/h (9.81 X 3 +11.73) (Design point- 3X500MW- Stream No: <205> x 3 Units + Design point 3X200MW - Stream No: <205>)
				Retention Time	8.0 Hours
				Required volume	41.16 m3/h x 8.0 hr = 329.28 m3



Tank Level is designated as follows

Top	9.0
HH	8.5
H	8.3
L	1.2*
LL	1.0*

<u>Circular Tank</u>

Effective volume

= 8.0 m Φ ^ 2 / 4 x π x (8.3-1.2) m

= 356.88 m3> 329.28m3

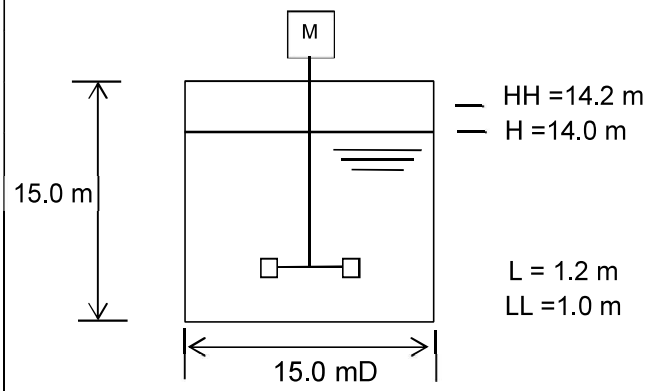
Hold Volume

= 8.0 m Φ ^ 2 / 4 x π x 8.5 m

=427.2 m3

*L and LL level is finalized by vendor's information of Waste water pump and agitator.

S. No	Item No	Service	Design Spec	Process Parameter	Design Basis
5	00HTK03BB001/002	Limestone slurry storage Tank	15000 mmD X 15000 mmH Quantity = 2 no. (1W+1S) (Common for combine absorber (3 X200 MW) and as well as for all 500 MW units.)	Process Capacity for each tank	a) Limestone required = 40.326 TPH (9.263 x 3 Units + 12.537) (Design point- 3X500MW- Stream No: <501> x 3 Units + Design point 3X200MW - Stream No: <501>) b) 20% (w/w) Limestone slurry = 40.326 TPH / 20% mass flow rate = 201.63 TPH per unit c) 20%(w/w) Limestone slurry density = 1.130 t/m3 d) 20% (w/w) Limestone slurry = 201.63 TPH / 1.130 volume flow rate = 178.44 m3/hr for all the 4 Absorbers.
				Retention Time	12.0 hr
				Required volume	178.44 m3/h x 12 hr = 2141.20 m3



Tank Level is designated as follows

Top	15.0
HH	14.2
H	14.0
L	1.2*
LL	1.0*

<u>Circular Tank</u>

Effective volume

= 15.0 m Φ ^ 2 / 4 x π x (14.0-1.2) m

= 2261.94 m3 > 2141.2 m3

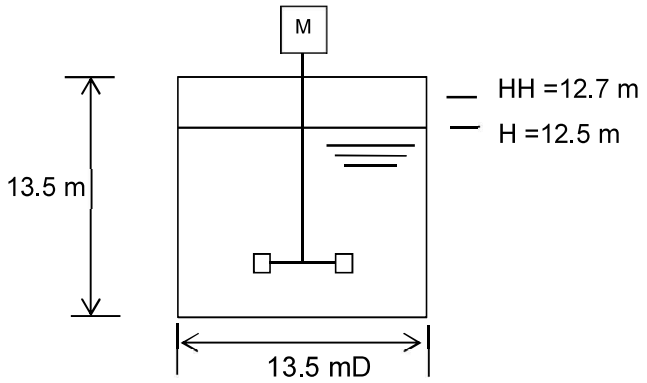
Hold Volume

= 15.0 m Φ ^ 2 / 4 x π x 14.2 m

= 2509.34 m3

*L and LL level is finalized by vendor's information of Limestone slurry Feed pump and agitator.

S. No	Item No	Service	Design Spec	Process Parameter	Design Basis
6	00HTK00BB001	Auxiliary Absorbent Tank	13500mmDX 13500mmH Quantity = 1 no (Common for combine absorber (3 X200 MW) and as well as for all 500 MW units.)	Process Capacity	Absorber Tank Volume = 1760 m3 (with 20 % margin) (3X200MW Absorber tank Size – 26.9mX10.9mX5.0m= 1466.05 m3 20 % margin =1466.05 X 1.2=1760.0 m3)
				Retention Time	Batch Operation
				Required volume	1760 m3



Tank Level is designated to be empty during normal operation. Therefore the volume from bottom to H is considered as hold volume of tank.

Top	13.5
HH	12.7
H	12.5
L	1.2*
LL	1.0*

<u>Circular Tank</u>

Effective volume

= 13.5 m Φ ^ 2 / 4 x π x 12.5 m

= 1789.23 m3>1760 m3

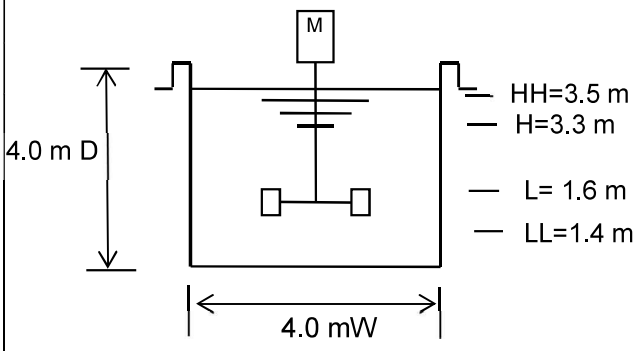
Hold Volume

= 13.5 m Φ ^ 2 / 4 x π x 12.7 m

= 1818 m3

*L and LL level is finalized by vendor's information of Auxiliary Absorbent tank pump and agitator.

S. No	Item No	Service	Design Spec	Process Parameter	Design Basis
7	10/40HTT 00BB001	Absorber Area Drain Sump	4000mmW X 4000mmL X 4000mmH Quantity = 4 nos. (One (1) number for each absorber)	Process Capacity for each Sump	25 m3
				Retention Time	Batch Operation
				Required volume	25 m3



Tank Level is designated as follows

Top	4.0
HH	3.5
H	3.3
L	1.6*
LL	1.4*

Rectangular Tank

Effective volume

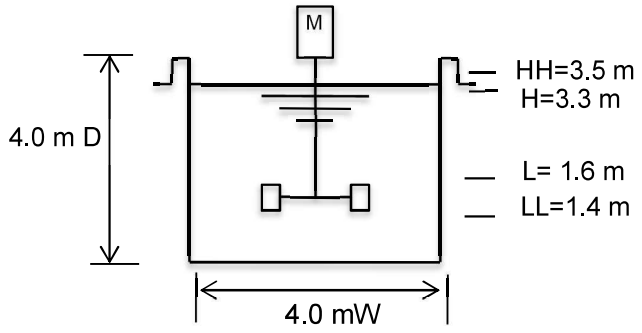
= 4.0 m x 4.0 m x (3.3-1.6) m = 27.2 m3 >25 m3

Hold Volume

= 4.0 m x 4.0 m x 3.5 m = 56 m3

*L and LL level is finalized by vendor's information of Sump pump and agitator.

S. No	Item No	Service	Design Spec	Process Parameter	Design Basis
8	00HTT01 BB001	Gypsum Area Drain Sump	4000mmW X 4000mmL X 4000mmH Quantity = 1 no. (Common for combine absorber (3 X200 MW) and as well as for all 500 MW units.)	Process Capacity	25 m3
				Retention Time	Batch Operation
				Required volume	25 m3



Tank Level is designated as follows

Top	4.0
HH	3.5
H	3.3
L	1.6*
LL	1.4*

<u>Rectangular Tank</u>

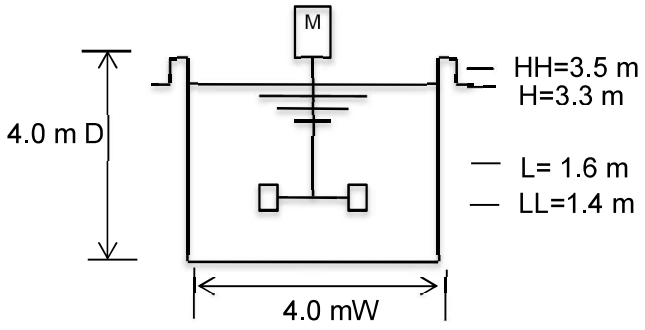
Effective volume

= 4.0 m x 4.0 m x (3.3-1.6) m = 27.2 m3 >25 m3

Hold Volume

= 4.0 m x 4.0 m x 3.5 m = 56 m3

*L and LL level is finalized by vendor's information of Sump pump and agitator.

S. No	Item No	Service	Design Spec	Process Parameter	Design Basis
9	00HTT02 BB001	Lime Stone Area Drain Sump	4000mmW X 4000mmL X 4000mmH Quantity = 1 no. (Common for combine absorber (3 X200 MW) and as well as for all 500 MW units.)	Process Capacity	25 m3
				Retention Time	Batch Operation
				Required volume	25 m3
					Tank Level is designated as follows Top 4.0 HH 3.5 H 3.3 L 1.6* LL 1.4* **<u>Rectangular Tank</u>** **Effective volume** = 4.0 m x 4.0 m x (3.3-1.6) m = 27.2 m3 >25 m3 **Hold Volume** = 4.0 m x 4.0 m x 3.5 m = 56 m3

*L and LL level is finalized by vendor's information of Sump pump and agitator.

The above data is basic design data and may vary based on actual piping layout and selected vendor's recommendations.

Reference Documents

- Mass Flow Balance (3X500 MW Design Point + 3X200 MW Design Point) data- 3310-109-PV M-W-002

1. **Gas condition for Water Tank Sizing:**

S.No.	Gas Condition	Feature
1	VWO	Maximum Absorbed SO_2 Condition Maximum Inlet Gas flow condition

2. **Water Tank Sizing Basis**

Tank size is decided as per the following

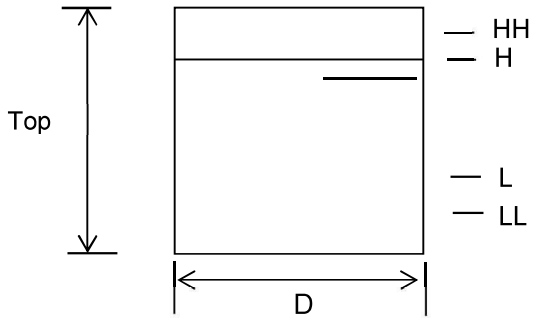
LL – Pump LL level m

L – LL + 0.2 m

H - Effective height m

HH - H + 0.2 m

Top - HH + 0.5 m

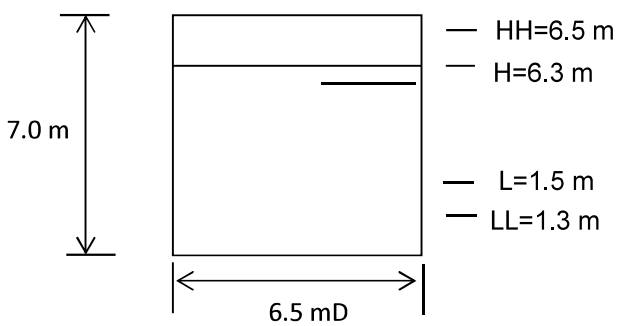


Effective volume = 3.14 / 4 x Φ ^ 2 x (H-L)

Hold volume = 3.14 / 4 x Φ ^ 2 x (HH)

Top/D ratio = 1-1.2

S. No	Item No	Service	Design Spec	Process Parameter	Design Basis
1	00HTQ00BB001/002	Process Water Tank	6500 mmD X 7000 mmH Quantity = 2 nos. (Common for combine absorber (3 X200 MW) and as well as for all 500 MW units.)	Process Capacity	611.14m3/h ((7.60+25.83+0.77+76.18+11.38/2+21.83)X3) + ((9.63 +36.07+0.96 + 113.47 + 15.54/2 +29.54)) (Refer Mass Flow Balance (3X500 MW Design Point) data stream no. (<801> + <802> + <803> + <804> + <805>/2 + <806>) x 3 units) + (Refer Mass Flow Balance (3X200 MW Design Point) data stream no. (<801> + <802> + <803> + <804> + <805>/2 + <806>)).
				Retention Time	0.25 hr
				Required volume	611.14 m3/h x 0.25 hr = 152.79 m3



Tank Level is designated as follows

Top	7.0
HH	6.5
H	6.3
L	1.5
LL	1.3*

Effective volume

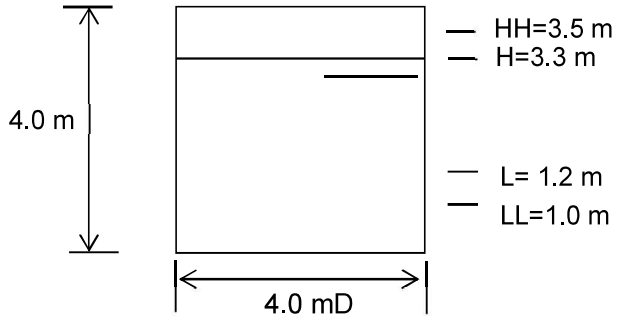
= 6.5 m Φ ^ 2 / 4 x π x (6.3-1.5) m = 159.27 m3>152.79 m3

Hold Volume

= 6.5 m Φ ^ 2 / 4 x π x 6.5 m = 215.69 m3

* LL level will be finalized by vendor's information of Process water pump.

S. No	Item No	Service	Design Spec	Process Parameter	Design Basis
2	00HTQ01BB001/002	Cake wash (Clarified water) Tank	4000 mmD X 4000 mmH Quantity = 2 nos. (Common for combine absorber (3 X200 MW) and as well as for all 500 MW units.)	Process Capacity for each tank	24.84 m3/h (11.38/2X3 + 15.54/2) Refer (Mass Balance (3X500M Design Point data) stream no. (<805>/2) x 3 units) + (Mass Balance (3X200MW Design Point data) stream no. (<805>/2).
				Retention Time	1hr
				Required volume	24.84 m3/h x 1hr = 24.84 m3



Tank Level is designated as follows

Top	4.0
HH	3.5
H	3.3
L	1.2
LL	1.0*

Effective volume

= 4.0 m Φ ^ 2 / 4 x π x (3.3-1.2) m

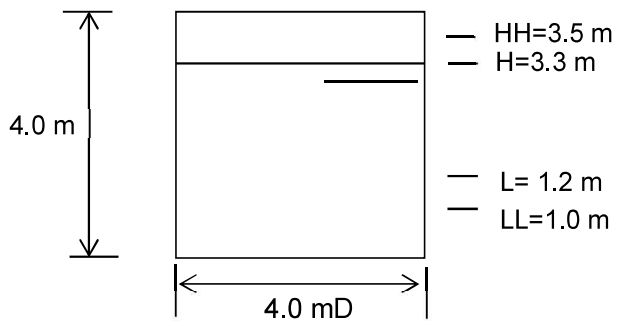
=26.39 m3 > 24.84 m3

Hold Volume

= 4.0 m Φ ^ 2 / 4 x π x 3.5 m

= 43.98 m3

*LL level is finalized by vendor's information of Cake wash tank pump.

S.No	Item No	Service	Design Spec	Process Parameter	Design Basis
3	00HTM01BB001/002	Belt Filter Wash Tank	4000 mmD X 4000 mmH Quantity = 2 no. (Common for combine absorber (3 X200 MW) and as well as for all 500 MW units.)	Process Capacity for each tank	24.84 m3/h (11.38/2X3 + 15.54/2) Refer (Mass Balance (3X500M Design Point data) stream no. (<805>/2) x 3 units) + (Mass Balance (3X200MW Design Point data) stream no. (<805>/2).
				Retention Time	1hr
				Required volume	24.84 m3/h x 1hr = 24.84 m3
					Tank Level is designated as follows Top 4.0 HH 3.5 H 3.3 L 1.2 LL 1.0* **Effective volume** = 4.0 m Φ ^ 2 / 4 x π x (3.3-1.2) m =26.39 m3>24.84 m3 **Hold Volume** = 4.0 m Φ ^ 2 / 4 x π x 3.5 m =43.98 m3

*LL level is finalized by vendor's information of belt filter wash tank pump.

Reference Documents

- Mass Flow Balance (3X500 MW Design Point + 3X200 MW Design Point) data- 3310-109-PVM-W-002

ANNEXURE-IV

MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION

	TITLE: (3x200+3x500) MW RAMAGUNDAM FGD TECHNICAL SPECIFICATIONS FOR AGITATORS OF FGD SLURRY TANKS	SPEC. NO.: PE-TS-467-571-18000-A003 SECTION-I, SUB-SECTION- D, ANNEXURE-IV REV. NO.: 0 DATE OCT 2021

DRAWINGS/ DOCUMENTS REQUIRED DURING DETAIL ENGINEERING

The successful bidder shall submit the following drawings / documents during detail engineering for approval / information / reference (as the case may be): -

Sl. No.	BHEL Drawing / Document No.	Title	Schedule Date	Drawing Classification
1	PE-V0-467-571-A001	GA drawing, Exploded view, sectional view with Material of construction, mechanical seal , gearbox for all Agitator models	2 weeks from LOI	Primary
2	PE-V0-467-571-A002	Data sheet for all Agitator	2 weeks from LOI	Primary
3	PE-V0-467-571-A003	Agitator Performance curve of all Agitators	2 weeks from LOI	Primary
4	PE-V0-467-571-A004	Electrical motor GA drawing & Data sheet and performance curves of all motors	2 weeks from LOI	Primary
5	PE-V0-467-571-A005	Quality plan & Inspection and Test Procedure	2 weeks from LOI	Primary
6	PE-V0-467-571-A006	Agitator and Motor Sizing Calculation	2 weeks from LOI	Primary
7	PE-V0-467-571-A007	O&M Manual for Agitator	4 weeks from LOI	Secondary
8	PE-V0-467-571-A008	Utility Consumption	4 weeks from LOI	Secondary
9	PE-V0-467-571-A009	Foundation Data including Anchor plan	4 weeks from LOI	Secondary
10	PE-V0-467-571-A010	Lubricating oil list	4 weeks from LOI	Secondary
11	PE-V0-467-571-A011	Special tools list, Start-up & Commissioning Spares	4 weeks from LOI	Secondary
12	PE-V0-467-571-A012	Installation and assembly procedure including Pre Commissioning Check List	4 weeks from LOI	Secondary

	TITLE:	SPEC. NO.: PE-TS-467-571-18000-A003
	(3x200+3x500) MW RAMAGUNDAM FGD TECHNICAL SPECIFICATIONS FOR AGITATORS OF FGD SLURRY TANKS	SECTION-I, SUB-SECTION- D, ANNEXURE-IV
		REV. NO.: 0 DATE OCT 2021

NOTEs:

1. Bidder to note that BHEL reserves the right for drawing/document submission through web based document management system. Bidder would be provided access to the DMS for drawing/document approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.

   a) internet explorer version – minimum internet explorer 7.
   b) Internet speed – 2 mbps (minimum preferred).
   c) Pop ups from our external DMS IP (124.124.36.198) should not be blocked.
   d) Vendor's internal proxy setting should not block DMS application's link (http://dmsserver.bhelpem.com/wrench%20web%20access/login.aspx.).

2. The above drawing list is tentative and shall be finalized with the successful bidder after placement of order. While some of the drawings indicated above may not be applicable, some additional drawings may also be required based on scope of work.
3. Drawings shall be prepared in Auto-Cad latest edition. Required no. of hard and soft copies (editable) of the drawings shall be furnished as per requirement specified elsewhere in the specification.
4. Only manual calculation with authentic supporting literature (e.g. extracts of hand Book/ standard/codes) shall be acceptable. All design calculations and drawings shall be in SI system only.
5. All the drawings and documents including general arrangement drawing, data sheet, calculation etc. to be furnished to the customer during detailed engineering stage shall include / indicate the following details for clarity w.r.t. Inspection, construction, erection and maintenance etc.:

a) All drawings and documents shall indicate the list of all reference drawings including General Arrangement.
b) All drawings shall include / show plan, elevation, side view, cross-section, skin section, blow-up view; all major self-manufactured and bought out items shall be labelled and included in BOQ / BOM in tabular form.
c) Painting schedule shall also be made as a part of general arrangement drawing of each equipment / items indicating at least 3 trade names.
d) All the drawings required to be furnished to customer during detailed engineering stage shall include technical parameters, details of paints and lubrication, hardness and BOQ / BOM in tabular form indicating all major components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.

	TITLE:	SPEC. NO.: PE-TS-467-571-18000-A003
	(3x200+3x500) MW RAMAGUNDAM FGD TECHNICAL SPECIFICATIONS FOR AGITATORS OF FGD SLURRY TANKS	SECTION-I, SUB-SECTION- D, ANNEXURE-IV
		REV. NO.: 0 DATE OCT 2021

e) Void.

f) Drawings and documents not covered above but required to check safety of machines/ system, shall be submitted during detailed engineering stage without any commercial implication.

g) All drawings shall include "B.O.M" and indicate quantity, material of construction, make along with IS/BS No., Technical parameters, dimensions, hardness, machining symbol and tolerance, requirement of radiography and hydraulic tests, painting details, elevation, side view, plan, skin section and blow-up view for clarity.

h) All drawings shall be prepared as per BHEL's title block and shall bear BHEL's drawing No. Documents marked for submission to BHEL's Customer shall also bear BHEL's Customer's drawing No.

i) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.

j) Bidder to follow the following the drawing submission schedule.

k) 1st submission of drawings from date of LOI as per the submission schedule.

l) Every revised submission incorporating comments – within 7 days.

m) Bidder to submit revised drawings complete in all respects incorporating all comments.

n) The primary drawings are to be considered as the basic engineering drawings.

Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. For any clarification/ discussion required to complete the drawings, the bidder shall depute his personal to BHEL for across the table discussions/ finalizations/ submissions of drawings.

SIGNATURE: _____

COMPANY SEAL

NAME : _____

	TITLE:	SPEC. NO.: PE-TS-467-571-18000-A003
	(3x200+3x500) MW RAMAGUNDAM FGD TECHNICAL SPECIFICATIONS FOR AGITATORS OF FGD SLURRY TANKS	SECTION-I, SUB-SECTION- D, ANNEXURE-IV
		REV. NO.: 0 DATE OCT 2021

DESIGNATION: _____

COMPANY: _____

	TITLE: (3x200+3x500) MW RAMAGUNDAM FGD TECHNICAL SPECIFICATIONS FOR AGITATORS OF FGD SLURRY TANKS	SPECIFICATION No: PE-TS-467-571-18000-A002	
		SECTION-I, SUB-SECTION- D	
		REV. 00	DATE: OCT 2021
		SHEET : 1 OF 1	

ANNEXURE-V

SEA-WORTHY PACKING PROCEDURE

SEAWORTHY PACKING
(PACKING INSTRUCTIONS FOR GENERAL COMPONENTS / ASSEMBLIES / EQUIPMENT)

1 GENERAL

This standard lays down packing instructions for seaworthy packing of Components /Assemblies/ Equipment to be dispatched against Customer's contracts, for which there are no special instructions issued by the Engineering Departments.

The Components/Assemblies need to be packed suitably to avoid physical damage & corrosion during transit for storage. For specific applications the concerned engineering department shall issue a product standard. Reference of this standard, must appear in the Shipping list/Packing List.

2 SCOPE

This procedure gives minimum guidelines for seaworthy packing to be complied with for packing of Components /Assemblies / Equipment. This packing shall be suitable for different handling operations and for the adverse conditions during transportation and during indoor / outdoor storage for periods more than one year.

3 CROSS REFERRED SPECIFICATION

- Multi-layered cross laminated plastic film : AA51420
- Packing Wood : AA51401
- Silica gel : AA55619
- Thermocole : AA51416
- Packing slip holders : AA7240901
- Corrugated Fibre Board : AA51414
- Rubber sheet : AA59001
- VCI paper : AA51406
- High quality full glossy out door finishing paint : AA56126
- Polyethylene air bubble film : IS 12787
- Structural steel - standard quality (plates, sections, strips flats & bars) : AA10108
- International Standards For Phytosanitary Measures No. 15 : ISPM-15:2009

4 WOOD SPECIFICATION FOR PACKING

The wood shall conform to specification AA51401.

For export packing wood in addition to the above the following has to be met:

The standard requires the use of debarked wood in the construction of compliant wood packaging material. Debarked wood is defined in the ISPM 5.

5 TYPE OF PACKING

The following 5 types of packings have been standardized for packing of General Components /Assemblies.

- 'OP' - Open Type
- 'PP' - Partially Packed
- 'CP' - Crate Packing - Components/Equipment requiring physical protection
- 'CQ' - Case Packing - Small medium Components/ Assemblies/ Equipment which require corrosion & physical protection
- 'CR' - Case Packing - Electrical Components/Assemblies which require special packing viz. Water Proof, Shock Proof, etc.

6 DESCRIPTION OF TYPES OF PACKING

The various types of packing, as standardized above, are described below.

6.1 'OP' - Open Type

In case, of components which are not affected by water & dust & do not require special protection &, are generally not machined, shall be sent as open packages. However these components may be sent in crates, wherever necessary.

6.2 'PP' - Partially Packed

Components which need special protection, at selected portions only, shall be dispatched partially packed. Machined surfaces should not be allowed to come directly in contact with the wood. Such surfaces after application of TRP should be protected with Multi-layered cross laminated plastic film to AA51420.

6.3 'CP' - Crate Packing – General

Assemblies/Components which need only physical protection from the point of view of handling shall be dispatched duly packed in crates.

6.4 'CQ' - Case Packing - Machined Components/Assemblies/Equipment

a) Small & Medium sized components/assemblies/equipment due to size/weight & to avoid handling, and pilferage, problems shall be packed in Case/Containers.

b) Wherever required adequate quantity of silica gel to AA55619 or VCI Powder/ Tablets, packed in thin muslin cloth cotton bags shall be suitably placed.

c) Small machines/components of less weight shall be provided with suitable cushioning. Wood Wool/Expanded Polyethylene Foam Sheet, if used, shall be sandwiched between polyethylene sheets and sealed.

d) The components inside the case shall be entirely covered with Multi-layered cross laminated plastic film to AA51420, where-ever required.

6.5 'CR' - Case Packing - Electrical & Electronic Components/Assemblies

Delicate components likely to be damaged e.g. Gauges, Instruments etc. are to be wrapped in waxed paper or polyethylene air bubble film and packed in cartons.

a) Adequate quantity of Silica gel to AA55619 packed in cotton bags, of 100 grams each are to be suitably placed in the cartons. The cartons shall be entirely covered with Multi-layered cross laminated plastic film to AA51420, before being packed in the cases.

b) VCI Powder/Tablets can be used as an alternative to Silica Gel to AA55619.

c) Empty space in the cartons shall be filled with small chips of Expanded Polystyrene (Thermocole), Wood Wool etc. Polyethylene air bubble film shall conform to IS 12787/AA51420 Expanded polystyrene (Thermocole) shall conform to AA51416.

d) The cartons shall be manufactured from corrugated Fibre Board, meeting requirements of AA51414.

6.6 Special Packing

Components requiring special packing (as per customer/contractual/ engineering requirements) not ncluded in this specification shall be covered by product standards.

7 PREPARATION OF PACKING CASE

1) Cases and crates with gross weight up to 1,000 kgs. shall be provided with bottom cleats of min. 40 mm thicknesses to ensure clearance for handling by forklift. Cases and crates exceeding gross weight of 1,000 kgs. shall be provided with skid runners, number and size according to weight of package.
2) The base of the case shall be made of wooden batons for planks giving necessary reinforcement, such that the bottom of the equipment is at a height of 100 to 200 mm from the ground level depending upon size & weight of equipment. However for packing cases of smaller size equipment can be at a height of 40 mm from the ground level.
3) In case of 'CR1 - Packing Viz. Electrical & Electronic components for instruments/assemblies, a rubber sheet, Self-expanded polyethene foam sheet, preferably 10 mm thick, shall be fixed on to the base to act as cushioning to the equipment.
4) The four sides, shall be lined, from inside with multi-layered cross-laminated polyethylene sheet of 90GSM as per AA51420 and tacked at suitable places.

   Whenever specified the top cover will have a layer of multi-layered cross laminated polyethylene sheet of 90 GSM over the cover. This should project about 100 - 250mm on all sides.

   It is preferable to have a single piece of the above Multi-layered cross laminated polyethylene sheet fixed on the four sides. In case jointing is unavoidable, it should be done by overlapping of approximately 100mm.
5) Place the Components/cartons with corrosion inhibitors duly applied wherever necessary for place suitably, thin muslin cloths bags containing 100 grams (approx.) of activated Blue Silica Gel to AA55619, wherever necessary. Alternatively VCI Powder or Tablet may be used.
6) In case, depression is formed, at the top, after the equipment is lowered, provide ply board/wooden batons.
7) Cover the whole equipment with polyethylene sheet of at least 100 micron thickness, on all sides preferably by a single piece.
8) For indoor panels/equipment, provide suitable packing batons with covering of Thermocole/expanded soft polyethylene foam/polyethylene air bubble film wrapped with suitable cords, to avoid cutting of the polyethylene sheet so that finished surface is not damaged.
9) Empty space in the box shall be filled with adequate cushioning material e.g. Thermocole Chips, Wood Wool etc. to avoid movement for shocks. Alternatively put wooden blocks/batons wherever necessary.
10) The inner side of the top cover shall be lined with polyethylene sheet, of at least
11) 100 micron thickness, which shall project approximately 25 to 150 mm depending upon the size of the case on all sides of the top cover shall be provided below the top cover. This projection, after nailing the top cover, shall be folded over, on the sides of the crates & tacked, to, prevent ingress of water from the top.
12) For specific requirement of packing the cases are to be provided with Tongue and Groove joints.

8 STEEL CONTAINERS

Steel containers for packing can be used in case of repeated supplies of the same equipment. Empty steel containers are to be returned back from customer's end and to be reused for the next supplies.

The containers are to be made of structural steel as per AA10108 with proper reinforcement with I, C and T Sections.

Following precautions are to be taken during packing:

- Put the Components/Assemblies/Equipment in the steel container properly. Cover the Components/Assemblies/Equipment with polythene.
- To arrest the movement in the steel container necessary wooden Blocks/Batons may be put.
- Put cover on steel, container and Bolt Properly.

9 SEALED PACKING

Components sub-assemblies and assemblies sensitive to climatic conditions shall be packed seal tight. All the openings of the sensitive components, sub-assemblies and assemblies shall be blanketed to prevent the ingress of dust and moisture.

The components sub-assemblies and assemblies are completely covered with 2 layers of polyethylene sheet. All sharp corners and edges are to be protected by rubber mats to prevent the polyethylene sheet from damage. Top surface of the case shall be free from dents to prevent rain water pockets.

10 SLING PLATE

Sling plate shall be provided to prevent damage to the packing box during lifting. Size of the sling plate shall be selected depending upon the net weight of the consignment.

11 PACKING SLIP HOLDERS

Two nos. steel packing slip holders, specification no. AA7240901 containing the packing list, sealed in thick polyethylene film, shall be fixed one inside and the other outside the packing box.

12 Volatile Corrosion Inhibitor (VCI) Paper

a) Un-protected surfaces of steel and cast iron components, tools bearing, shaft seals etc. are covered with VCI paper. VCI paper has been impregnated with corrosion inhibitors which by evaporation and chemical conversion protect metals in an enclosed area against corrosion.

b) 7 m^3 VCI paper is necessary for 1 m^3 of packed item approximately as per AA51406.

Application Limitation:

VCI paper shall not be used for components made of aluminium, aluminium alloys as well as Zinc, copper, brass, cadmium and silver.

VCI powder is sprinkled inside the piping components ends shall be protected with end cover as specified in plant standards, drawings.

13 Moisture Absorber

Silica gel is used for this purpose to protect the contents over sufficiently long time from corrosion. At the time of use, silica gel should be so dried that its colour becomes dark blue. These shall be filled in small cotton bags. Before sealing the equipment, the silica gel bags should be kept inside the polyethylene film cover at different locations. The quantity of silica gel should not be less than 1.0 kg per cubic metre volume of the packing box

14 GENERAL PRECAUTIONS

a) While fixing nails during packing, necessary care shall be taken to ensure that materials used for protection inside the case e.g. paper, polyethylene sheet, coir etc. do not get damaged.

b) Sling protection brackets to be provided on cases wherever required.

c) It shall be ensured that all stencil marks external, front & rear sides of the casing shall be of water proof Material to prevent obliteration in transit.

d) The various caution signs shall be marked with stencil on both sides of the packing box.

e) Do not pack any other Mechanical items with this case (do not use any other non-permitted packing materials).

THE FOLLOWING DETAILS ARE TO BE MARKED ON THE PACKING CASES.

a) Address of consignee.

b) Purchase Order No./ SO No/WO No.

c) Description of item or title of packing list.

d) Case identification Number/ Packing List No.

e) Net Weight.

f) Gross Weight.

g) Dimensions of box

h) Marking showing upright position.

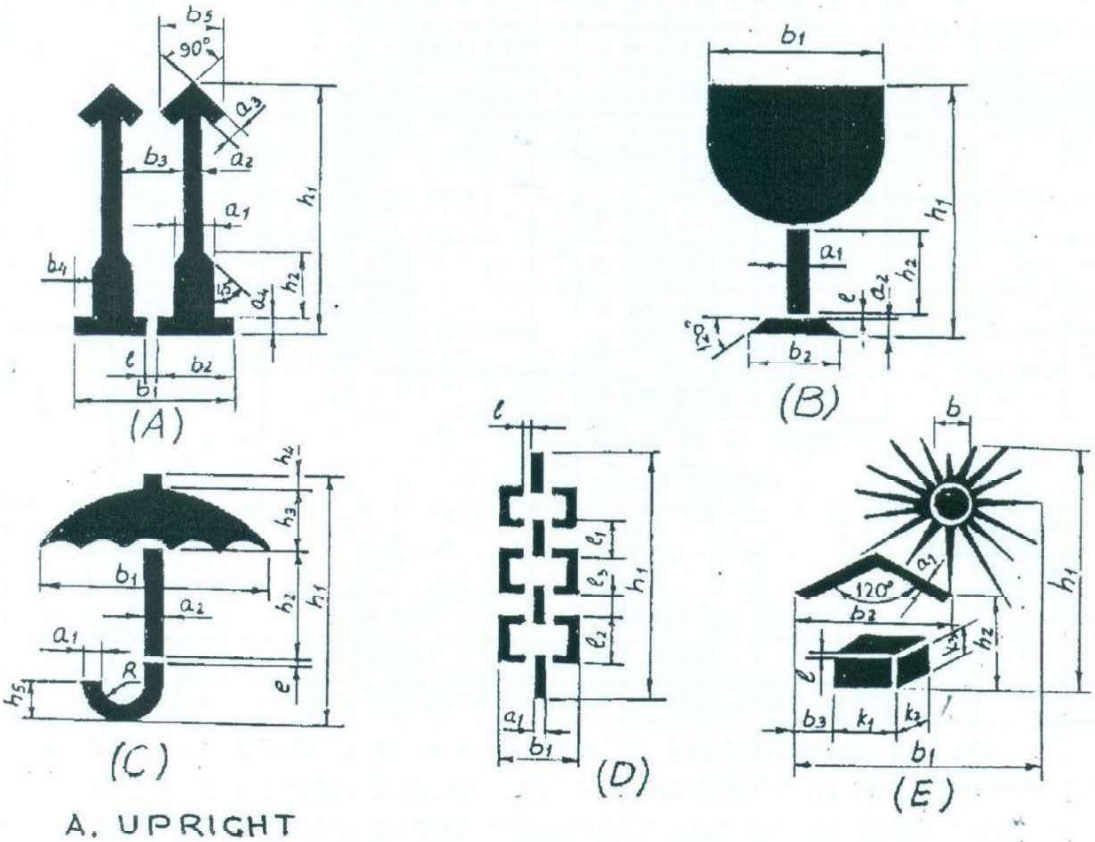
i) Marking showing sling position.

j) Marking showing umbrella (i.e. for machines/components to be stored under covered storage.

k) Loading and unloading precautions

MARKINGS ON PACKING CASES

1. THIS PLANT STANDARD PRESCRIBES THE VARIOUS CAUTION SIGNS AND OTHER MARKINGS ON PACKING CASES.
2. DIMENSIONS IN THE TABLE 1 SHALL BE USED FOR MAKING STENCILS ONLY.



A. UPRIGHT
B. FRAGILE
C. PROTECTION FROM FALLING OR CONDENSING MOISTURE.
D. SLINGING POSITION
E. PROTECTION FROM DIRECT RADIATIONS.

Figure 1

CENTER OF GRAVITY

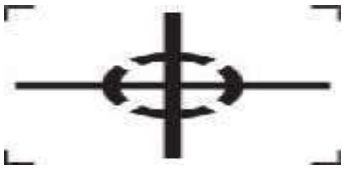


Figure 2

Table 1

DESIGNATION		DIMENSIONS IN mm.																						
		a_1	a_2	a_3	a_4	b_1	b_2	b_3	b_4	b_5	b	l	h_1	h_2	h_3	h_4	h_5	K_1	K_2	K_3	l_1	l_2	l_3	R
A	1	12	5	5	4	52	25	19	8	21	–	2	84	23	–	–	–	–	–	–	–	–	–	–
	2	17	7	7	6	75	36	29	11	30	–	3	119	33	–	–	–	–	–	–	–	–	–	–
	3	24	10	10	8	104	50	38	16	42	–	4	168	46	–	–	–	–	–	–	–	–	–	–
	4	34	14	14	11	147	71	59	23	60	–	5	239	65	–	–	–	–	–	–	–	–	–	–
B	1	5	5	–	–	50	33	–	–	–	–	2	84	25	–	–	–	–	–	–	–	–	–	–
	2	7	7	–	–	71	47	–	–	–	–	3	119	36	–	–	–	–	–	–	–	–	–	–
	3	10	10	–	–	100	66	–	–	–	–	4	168	50	–	–	–	–	–	–	–	–	–	–
	4	14	14	–	–	142	94	–	–	–	–	5	239	71	–	–	–	–	–	–	–	–	–	–
C	1	4	3	–	–	66	–	–	–	–	–	2	80	39	19	5	11	–	–	–	–	–	–	6
	2	6	4	–	–	85	–	–	–	–	–	3	114	55	27	7	16	–	–	–	–	–	–	9
	3	8	6	–	–	120	–	–	–	–	–	4	160	78	38	10	22	–	–	–	–	–	–	12
	4	11	9	–	–	170	–	–	–	–	–	5	227	110	54	14	31	–	–	–	–	–	–	17
D	1	6	–	–	–	30	–	–	–	–	–	4	148	–	–	–	–	–	–	–	30	30	10	–
	2	9	–	–	–	42	–	–	–	–	–	5	209	–	–	–	–	–	–	–	42	42	14	–
E	1	3	–	–	–	69	47	10	–	–	16	2	91	26	–	–	–	17	8	11	–	–	–	–
	2	4	–	–	–	98	67	15	–	–	23	3	128	33	–	–	–	24	11	16	–	–	–	–
	3	6	–	–	–	138	94	20	–	–	32	4	182	62	–	–	–	34	16	22	–	–	–	–

Black and Red Marking Ink to IS: 1234 "Ink, Stencil, Oil Base, For Marking Porous Surfaces" or duplicating ink stencilling, oil base for marking porous surfaces.

All cases containing fragile items are to be stencilled with red marking and stencilling paint/ink.

"HANDLE WITH CARE", "FRAGILE DO NOT TURN OVER".

Besides the caution signs the product information shall be stencilled of letters with 13mm to 50mm height.

In case of consignment consists of more than one package, each package shall carry its Package No. as given in shipping list. All caution signs shall be stencilled in higher quality full glossy out door finishing paint red in colour (AA56126). All other markings shall be carried out in black enamel (AA56126).

Caution signs & other markings shall be stencilled on both the end shooks & the side shooks. Caution sign (for slinging) shall be stencilled only on side shooks at the appropriate place.

Note: In case the size of package is small for using the stencils, then hand written letters/figures shall be allowed.

15 PROCEDURE FOR HANDLING OF COMPONENTS

The purpose of this procedure is to protect the quality of the components/equipment while handling in various stages of manufacturing packing & despatching.

15.1 Adequate care shall be taken in handling the material, and components to avoid damage during receipts, storage issue manufacture & despatch operations.

15.2 Appropriate material handling equipment like fork lifters, cranes etc. Shall be used where needed.

15.3 Lifting by crane and transportation by trolley of critical items and large components like rotors castings etc. Shall be done carefully.

15.4 For critical items, where specified, special handling fixtures shall be used for lifting.

15.5 Slings and shackles used for lifting the components/equipment shall be checked for fitness and suitability before use.

15.6 Slings used on machined surfaces shall be suitably padded. No slings shall be used on journal surfaces.

15.7 Precision machined components like blades, catches, rollers etc. Shall be lifted using suitable wooden pallets.

15.8 HANDLING OF COMPONENTS ON RECEIPT/DESPATCH:

Before loading/unloading a packing case from the carrier look for the following shipping instructions painted on the packing case.

- The markings showing the upright position.
- The markings showing the sling position
- Markings showing the fragile contents.
- Other required markings as per Clause No. 12

15.8.1 Appropriate cranes and slings should be used for different components/ cases. Slings should normally make an angle as minimum as possible (width wise) but in no case more than 15º.

15.8.2 Handling and lifting should be done without jerks or impacts.

15.8.3 Immediately after receipt of the goods, the packing should be examined all-round for any sign of damage. If necessary, lift the cover or a number of boards of the case so as to make the contents visible. In the event of sealed packing being used the plastic sheeting should not be damaged. It is imperative that the packing material is restored in original condition after the inspection.

15.8.4 On receipt of the equipment it should be checked with the shipping list and missing or damage if any should be reported immediately. It is important to arrange for immediate examination to determine the extent of the damage, the cause of the damage and where applicable the person or persons responsible for the damage. According to general practice when transporting by railway or by road vehicle the carrier concerned should be immediately called upon (within specified periods) for jointly establishing a statement of the damage. This is essential as a basis for a subsequent claim and possible damage report to the insurance company.

15.8.5 Protective coating applied on machined surfaces should not be disturbed. The plastic covering should be put back carefully so that it prevents ingress of dust and moisture. Some packing may have vapour phase inhibitor (VPI) paper enclosed inside the packing cases. This should be restored to its original place as far as possible.

15.8.6 Silica gel and such other chemicals kept in the box as desiccants and indicators should also be left in the box itself.

16 GI SHEET

The packing cases are covered with GI sheet on outside for sides and top; inside for bottom as per the Figure-3 (GI sheet covering is applicable for all closed type of wooden packing).

17 Treatment of Wood & Application and use of the mark

For seaworthy export packing, treatment of wood has to be carried out as below subject to BHEL Engg & QC approval.

As per customer requirement for export packing, wood to be treated as applicable should be done as per International Standards for Phytosanitary Measures ISPM: 15 to control the growth stages viz. egg to adult of structural insects (beetles, borers, bugs, fleas, flies, lice, moths, roaches, termites) and other pests (mice, rats, spiders) etc. in stored products.

The specified marks applied to wood packaging material treated in accordance with ISPM 15 must conform to the requirements described in Annex 2 of ISPM 15.

17.1 Heat treatment using a conventional steam or dry kiln heat chamber (treatment code for the mark: HT)

When using conventional heat chamber technology, the fundamental requirement is to achieve a minimum temperature of 56 °C for a minimum duration of 30 continuous minutes throughout the entire profile of the wood (including its core).

This temperature can be measured by inserting temperature sensors in the core of the wood. Alternatively, when using kiln-drying heat chambers or other heat treatment chambers, treatment schedules may be developed based on a series of test treatments during which the core temperature of the wood at various locations inside the heat chamber has been measured and correlated with chamber air temperature, taking into account the moisture content of the wood and other substantial parameters (such as species and thickness of the wood, air flow rate and humidity). The test series must demonstrate that a minimum temperature of 56 °C is maintained for a minimum duration of 30 continuous minutes throughout the entire profile of the wood.

Treatment schedules should be specified or approved by the National Plant Protection Organisation (NPPO). Treatment providers should be approved by the NPPO.

17.2 Heat treatment using dielectric heating (treatment code for the mark: DH)

Where dielectric heating is used (e.g. microwave), wood packaging material composed of wood not exceeding 20 cm when measured across the smallest dimension of the piece or the stack must be heated to achieve a minimum temperature of 60 °C for 1 continuous minute throughout the entire profile of the wood (including its surface). The prescribed temperature must be reached within 30 minutes from the start of the treatment.

Treatment schedules should be specified or approved by the NPPO.

17.3 Methyl bromide treatment (treatment code for the mark: MB)

Wood packaging material containing a piece of wood exceeding 20 cm in cross-section at its smallest dimension must not be treated with methyl bromide.

The fumigation of wood packaging material with methyl bromide must be in accordance with a schedule specified or approved by the NPPO (National Plant Protection Organisation) that achieves the minimum concentration-time product (CT) over 24 hours at the temperature and final residual concentration specified in Table 1. This CT must be achieved throughout the profile of the wood, including its core, although the concentrations would be measured in the ambient atmosphere. The minimum temperature of the wood and its surrounding atmosphere must not be less than 10 °C and the minimum exposure time must not be less than 24 hours. Monitoring of gas concentrations must be carried out at a minimum at 2, 4 and 24 hours from the beginning of the treatment. In the case of longer exposure times and weaker concentrations, additional measurement of the gas concentrations should be recorded at the end of fumigation.

If the CT is not achieved over 24 hours, corrective action needs to be taken to ensure the CT is reached; for example, the treatment is restarted or the treatment time extended for a maximum of 2 hours without adding more methyl bromide to achieve the required CT (see the footnote to Table 2).

Table 2 – Minimum CT over 24 hours for wood packaging material fumigated with methyl bromide

Temperature (°C)	CT (g·h/m^3) over 24 h	Minimum final concentration (g/m^3) after 24 h#
21.0 or above	650	24
16.0 – 20.9	800	28
10.0 – 15.9	900	32

In circumstances when the minimum final concentration is not achieved after 24 hours, a deviation in the concentration of ~5% is permitted provided additional treatment time is added to the end of the treatment to achieve the prescribed CT.

One example of a schedule that may be used for achieving the specified requirements is shown in Table 3.

Table 3 – Example of a treatment schedule that achieves the minimum required CT for wood packaging material treated with methyl bromide (initial doses may need to be higher in conditions of high sorption or leakage)

Temperature (°C)	Dosage (g/m^3)	Minimum concentration (g/m^3) at:		
		2 h	4 h	24 h
21.0 or above	48	36	31	24
16.0 – 20.9	56	42	36	28
10.0 – 15.9	64	48	42	32

Treatment providers should be approved by the NPPO.

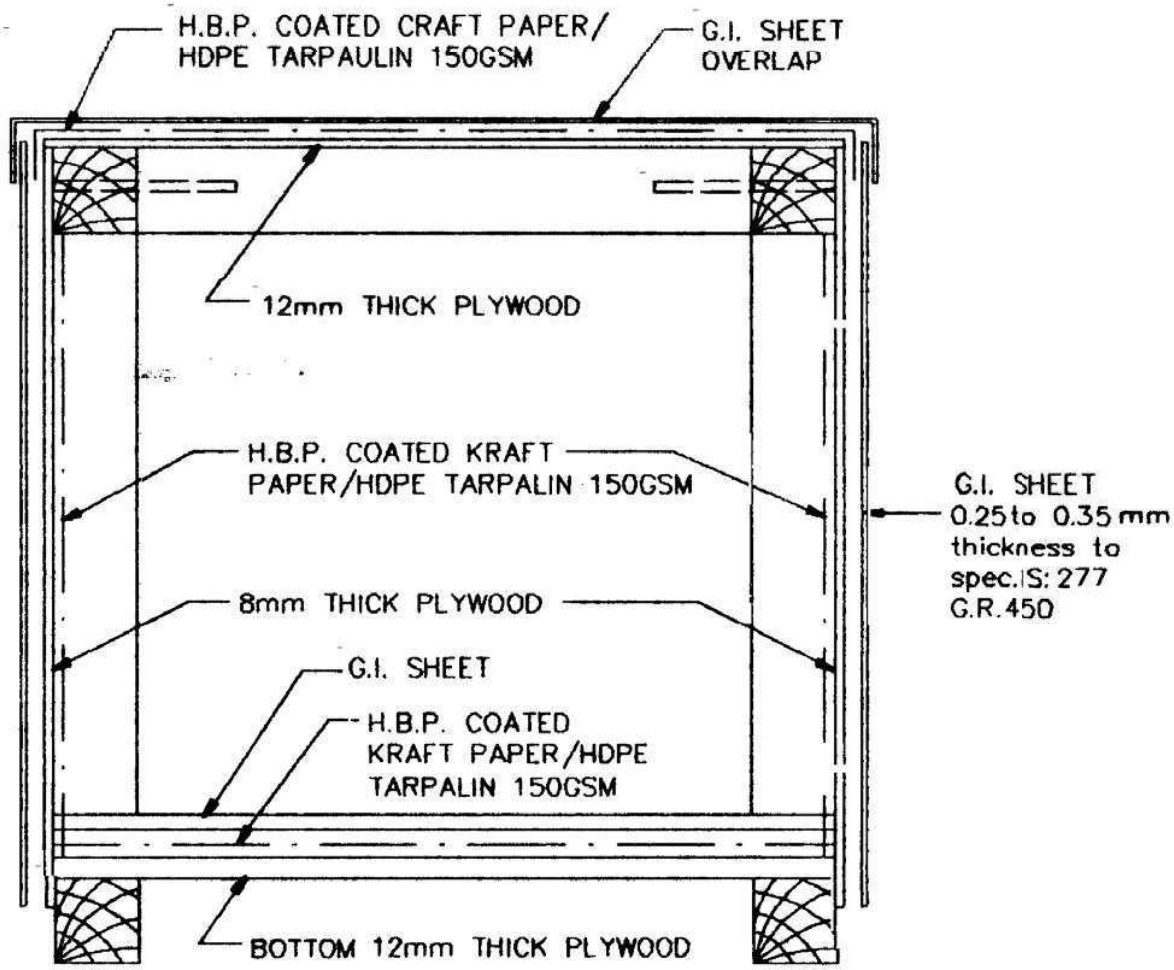
17.4 Marking

The specified marks applied to wood packaging material treated in accordance with ISPM 15 must conform to the requirements described in ISPM 15.

18 PROVISION FOR INSPECTION

This clause is applicable only where contractual requirement of customer is there. For other packings this is not applicable.

Each transportable packing's shall have provision for inspection by customer authority etc. during transport from origin of dispatched till destination. This inspection may require opening of the package and subsequently closing it again. For this purpose suitable designed opening with bolted cover shall be provided. Such an opening shall be clearly marked as "OPENING" with clear instruction for opening & closing written on this cover. For large consignment the size of the opening shall be suitable to facilitate entry of personnel.



CLOSED PACKING CASE WITH
G.I.SHEET SHOWING LAYERS
OF PACKING MATERIALS

Figure 3

	(3x200+3x500) MW RAMAGUNDAM FGD TECHNICAL SPECIFICATION FOR AGITATORS OF FGD SLURRY TANKS	SPECIFICATION No: PE-TS-467-571-18000-A002 SECTION : II REV: 00 DATE: OCT 21 SHEET 1 OF 1

SECTION - II

	(3x200+3x500) MW RAMAGUNDAM FGD TECHNICAL SPECIFICATIONS FOR AGITATORS OF FGD SLURRY TANKS LIST OF DOCUMENTS TO BE SUBMITTED WITH BID	SPECIFICATION No: PE-TS-467-571-18000-A002	
		SECTION : II	
		ANNEXURE-1	
		REV: 00	DATE: OCT 2021
		SHEET 1 OF 1	

BIDDER SHOULD SUBMIT THE SIGNED AND STAMPED COPY OF THE FOLLOWING DOCUMENTS:

Document for Evaluation:

1. Compliance cum confirmation certificate (Refer Annexure-2 of section-II).
2. Pre-bid clarification, if any, as per format given under Section-II (Annexure-3)
3. Amendment to specification, if any, issued by BHEL dully signed and stamped.
4. Deviation schedule as per format given under Section-II (Annexure-4), in case of any deviations by bidder.
5. Documents for meeting the Pre-Qualification Requirement (3K format has to be submitted along with supporting documents as given under Annexure-10, section-II).
6. List of special tools and tackles (Refer Annexure-7 of section-II).
7. Dully filled Guaranteed power consumption format (In the format attached with the price schedule) declaring guaranteed power consumption value in KW along with the Technical offer.

Document for Reference:

1. Agitator Schedule filled up by the bidder (Refer Annexure-8 of section-II).
2. GA drawing, Exploded view with Material of construction, total weight of all Agitators models offered.
3. Agitator Motor Sizing Calculation.
4. Electrical Load data filled up by the bidder (Refer Annexure-5 of section-II).
5. Test arrangement at shop
5. Product catalogue for offered agitators

Details mentioned under reference documents are subject finalization during detail engineering meeting requirements mentioned in various parts of the specification.

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing / stamping this compliance certificate (every sheet) and furnish same with the offer.

a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions, other than those mentioned under "exclusion and those resolved as per 'Schedule of Deviations', with regard to same.

b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'

c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL / CUSTOMER approval & customer hold points for inspection / testing shall be marked in the QP at the contract stage. Inspection / testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This is within the contracted price without any extra implications to BHEL after award of the contract.

d) All drawings/ data-sheets / calculations etc. submitted along with the offer shall not be taken cognizance off.

e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified / intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre-bid discussions, otherwise BHEL / Customer's decision shall be binding on the bidder whenever the deficiency is pointed out.

   For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.

f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.

g) All sub vendors shall be subject to BHEL / CUSTOMER approval in the event of order.

h) Guarantee for plant/equipment shall be as per relevant clause of GCC / SCC / Other Commercial Terms & Conditions

i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities within the scope of work as tender specification. This clause will apply in case during site commissioning, additional requirements emerges due to customer and / or consultant's comments. No extra claims shall be put on this account

j) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's / Customer's / Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.

k) As built drawings shall be submitted as and when required during the project execution.

l) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.

m) Successful bidder shall furnish detailed erection manual for each of the equipment supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.

n) Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.

o) In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.

	RAMAGUNDAM FGD PACKAGE AGITATOR	SPECIFICATION NO. PE-TS-467-571-18000-A002
		SECTION-II
		ANNEXURE-3
		REV 00 / OCT 2021
		SHEET: 1 OF 1

PRE-BID CLARIFICATION SCHEDULE

S.No.	Section/Clause/ Page No.	Statement of the referred clause	Clarification required

The bidder hereby certifies that above mentioned are the only clarifications required on the technical specification for the subject package.

SIGNATURE:_____

NAME : _____

DESIGNATION:_____

COMPANY: _____

DATE:_____

COMPANY SEAL

ANNEXURE-4

SCHEDULE OF TECHNICAL DEVIATION

(PLEASE REFER GCC FOR THE FORMAT OF DEVIATION)

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	NOs				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
ANNEXURE-5																		
Filtrate Water Tank Agitator				1	0				C									
Secondary Waste Water Hydro-cyclone Feed Tank Agitator				1	0				C									
Waste Water Tank Agitator				1	0				C									
Limestone Slurry Storage Tank Agitator				2	0				C									
Gypsum Area Drain Sump Agitator				1	0				C									
Limestone Area Drain Sump Agitator				1	0				C									
Auxiliary Absorbent Tank Agitator				3	0				C									
Primary hydro cyclone feed tank Agitator				1	0				C									
Absorber Area Drain Sump Agitator -1				1	0				C									
Absorber Area Drain Sump Agitator -2				1	0				C									
Absorber Area Drain Sump Agitator -3				1	0				C									
Absorber Area Drain Sump Agitator -4				1	0				C									

NOTES:
1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)/ CUSTOMER
2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V
: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)

ANNEXURE-5 LOAD DATA (ELECTRICAL)	JOB NO.	467	ORIGINATING AGENCY		PEM (ELECTRICAL)	
	PROJECT TITLE	RAMAGUNDAM STPP	NAME		DATA FILLED UP ON	
	SYSTEM	AGITATOR	SIGN.		DATA ENTERED ON	
	DEPTT. / SECTION	MAUX	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE	

	(3x200+3x500) MW RAMAGUNDAM FGD TECHNICAL SPECIFICATIONS FOR AGITATORS OF FGD SLURRY TANKS SUB-VENDOR LIST	SPECIFICATION NO. PE-TS-467-571-18000-A002 SECTION : II ANNEXURE : 6 REV 00 DATE: OCT 2021 SHEET 1 OF 1

LIST OF MAKES OF ITEMS

S.N.	ITEM NAME	MANUFACTURER	LOCATION

	TITLE: (3x200+3x500) MW RAMAGUNDAM FGD TECHNICAL SPECIFICATIONS FOR AGITATORS OF FGD SLURRY TANKS	SPECIFICATION NO. PE-TS-467-571-18000-A002	
		SECTION : II	
		ANNEXURE-7	
		REV 00	DATE: OCT 2021
		SHEET: 1 OF 1	

LIST OF SPECIAL TOOLS AND TACKLES

Bidder shall supply a set of special tools and tackles required either for erection or operation or maintenance of the agitator units. A list of such tools and tackles shall be submitted along with the offer in the format below.

Sl.no.	Description of item	Quantity

In case bidder indicates that no special tools and tackles are required but the same is found applicable during detailed engineering the same shall be supplied by the bidder without any commercial and delivery implications.

SIGNATURE:_____

NAME : _____

DESIGNATION:_____

COMPANY: _____

DATE:_____

COMPANY SEAL

ANNEXURE-8

RAMAGUNDAM TPS - AGITATOR SCHEDULE (To be sumbmitted with the offer by Bidder)

REV-0

Sl.No.	Description	Auxiliary Absorbent Tank Agitator	Limestone Slurry Storage tank Agitator	Primary Hydrocyclone feed tank Agitator	Secondary Hydrocyclone feed tank Agitator	Filtrate water tank Agitator	Waste water Tank Agitator	Absorber Area Drain Pit Agitator	Gypsum Dewatering Area Drain Pits Agitator	Ball Mill Area Drain Pit Agitator
1	Agitator Sl No.	1	2	3	4	5	6	7	8	9
2	Type	Blade turbine - marine propeller side entry	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)
3	Medium to be handled	Gypsum slurry	Limestone slurry	Gypsum slurry	Gypsum slurry	Gypsum slurry	Gypsum slurry	Gypsum slurry	Gypsum slurry	Limestone slurry
4	Seal Type	Mechanical seal (emergency flush start)	Not required	Not required	Not required	Not required	Not required	Not required	Not required	Not required
5	Duty	Intermittent- Whenever FGD is under maintenance	Continuous	Continuous	Continuous	Continuous	Continuous	Intermittent	Intermittent	Intermittent
6	Agitator Location	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor
7	Tank details									
a)	Tank Shape	Circular	Circular	Circular	Circular	Circular	Circular	Rectangular	Rectangular	Rectangular
b)	Tank name	Auxiliary Absorbent Tank	Limestone Slurry Storage tank	Primary Hydrocyclone feed tank	Secondary Hydrocyclone feed tank	Filtrate water tank	Waste water Tank	Absorber Area Drain Pit	Gypsum Dewatering Area Drain Pits	Ball Mill Area Drain Pit
c)	Capacity of Slurry (in m3)	1818	2509.4	322.5	189.4	158.3	427.2	56	56	56
	Dimension (in m)									
d)	Diameter	13.5	15.0	7.5	6.0	6.0	8.0	-	-	-
e)	Length	-	-	-	-	-	-	4	4	4
f)	Breadth	-	-	-	-	-	-	4	4	4
g)	Height	13.5	15.0	7.8	7.2	6.1	9.0	4	4	4
8	MOC of Agitator	**Refer Clause no 3.2, Material of construction in SECTION-I, SUB SECTION-C1 of Specific technical requirement (Mechanical)**								
9	Quantity of Agitator per tank	3 (Refer note-2)	1	1	1	1	1	1	1	1
10	Total quantity of agitators (for three units)	3 (Refer note-2)	2	1	1	1	1	4	1	1
11	Slurry Analysis									
a)	Slurry to be handled	Gypsem slurry	Limestone slurry	Gypsem slurry	Gypsem slurry	Gypsem slurry	Gypsem slurry	Gypsem slurry	Gypsem slurry	Limestone slurry
b)	Maximum solid particle size	200 mesh (74 μ)	200 mesh (74 μ)	200 mesh (74 μ)	200 mesh (74 μ)	6-7 mm	200 mesh (74 μ)	6-7 mm	6-7 mm	6-7 mm
c)	Normal solid particle size, d50	325 mesh (44 μ)	325 mesh (44 μ)	325 mesh (44 μ)	325 mesh (44 μ)	325 mesh (44 μ)	325 mesh (44 μ)	325 mesh (44 μ)	325 mesh (44 μ)	325 mesh (44 μ)
d)	Solid to be handled	gypsum along with Limestone & other impurities	Limestone + impurities	gypsum along with Limestone & other impurities	gypsum along with Limestone & other impurities	gypsum along with Limestone & other impurities	gypsum along with Limestone & other impurities	gypsum along with Limestone & other impurities	gypsum along with Limestone & other impurities	Limestone + impurities
e)	Chloride concentration	max 25000 ppm	max 1000 ppm	max 25000 ppm	max 25000 ppm	max 25000 ppm	max 25000 ppm	max 25000 ppm	max 25000 ppm	max 1000 ppm
f)	Hardness of particle	5-7 mohs scale	5-7 mohs scale	5-7 mohs scale	5-7 mohs scale	5-7 mohs scale	5-7 mohs scale	5-7 mohs scale	5-7 mohs scale	5-7 mohs scale
g)	Slurry concentration, wt%	30 wt%	30 wt%	30 wt%	16.60%	11%	3%	30%	30%	30 wt%
h)	Sp. Gravity of slurry	1.216	1.215	1.216	1.023	1.067	1.023	1.216	1.216	1.215
i)	Sp. Gravity of Lime Stone & Gypsum	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)

j)	Viscosity of Slurry	10 cP	30 cP	10 cP	4 cP	4 cP	3 cP	10 cP	10 cP	30 cP
k)	pH	4 to 8	5 to 8	4 to 8	4 to 8	4 to 8	4 to 8	4 to 8	4 to 8	5 to 8
l)	SiO_2 Content	4 to 6 g/l	4 to 6 g/l	4 to 6 g/l	4 to 6 g/l	4 to 6 g/l	4 to 6 g/l	4 to 6 g/l	4 to 6 g/l	4 to 6 g/l
m)	Temperature	Normal -61.4 deg C; Design-70 deg C.	Normal -45 deg C; Design-55 deg C.	Normal -61.4 deg C; Design-70 deg C.	Normal -61.4 deg C; Design-70 deg C.	Normal -58 deg C; Design-70 deg C	Normal -61.4 deg C; Design-70 deg C.	Normal -61.4 deg C; Design-70 deg C.	Normal -61.4 deg C; Design-70 deg C.	Normal -45 deg C; Design-55 deg C.
12	Motor									
a)	Total Power consumed	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder
b)	Motor Rating	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder
c)	Motor Explosion Proof Class	Non-Flame Proof	Non-Flame Proof	Non-Flame Proof	Non-Flame Proof	Non-Flame Proof	Non-Flame Proof	Non-Flame Proof	Non-Flame Proof	Non-Flame Proof
d)	Motor Protection Class	IP-55/ Outdoor	IP-55/ Outdoor	IP-55/ Outdoor	IP-55/ Outdoor	IP-55/ Outdoor	IP-55/ Outdoor	IP-55/ Outdoor	IP-55/ Outdoor	IP-55/ Outdoor
e)	Motor Efficiency Class	IE-3	IE-3	IE-3	IE-3	IE-3	IE-3	IE-3	IE-3	IE-3
13	Tank Levels									
a)	Minimum Liquid level In the tank (in M)	1.0	1.0	1.0	1.0	1.0	1.0	1.4	1.4	1.4
b)	Normal Liquid Level in the tank (in M)	12.5	14.0	7.1	6.5	5.4	8.3	3.3	3.3	3.3
c)	Maximum Liquid Level in the Tank (in M)	12.7	14.2	7.3	6.7	5.6	8.5	3.5	3.5	3.5
14	Impeller									
a)	Type of impeller	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder
b)	No. of impeller stages per agitator	-	2	1	1	1	2	1	1	1
c)	Impeller diameter	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder
d)	Impeller tip speed (Refer S.N. 19 c)	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder
e)	Operating speed	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder
f)	Agitator Pumping Capacity	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder
g)	Volume/Agitator	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder
h)	Power Number for Agitator	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder
15	Baffle Plates (not in bidder's scope)									
a)	No. & size of baffle plates	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder
c)	Thickness of baffle plates (mm)	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder
d)	Distance from Bottom of the tank	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder
16	Nozzle (not in bidder's scope)									
a)	Size of the nozzle on which agitator frame is mounted	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	NA	NA	NA
17	Loads									
a)	Static Load	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder
b)	Dynamic load	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder
c)	Torsional Moment (Nm)	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder
d)	Bending Moment (Nm)	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder	To be filled by bidder
18	Power loading for Auxiliary power consumption	Not applicable	Applicable	Applicable	Applicable	Applicable	Applicable	Not applicable	Not applicable	Not applicable
19	Parameters to be considered compulsarily by bidder for design of Agitators									

a)	Uniform suspension of solids by Agitators	The agitators shall keep the solid particles in suspended mode in liquid slurry with “Full off-Bottom Suspension” of solid particles to 98% of liquid column to virtually “Uniform Solid Concentration”.								
b)	Mounting of Agitaor (For Vertical Agitators)	The Agitators shall be mounted on the Agitator platform which shall be approximately at a height of 1.0 m from the tank roof. However, the Agitator platform is excluded from bidder's scope.								
c)	Maximum permitted impeller tip speed	12 m/s								
d)	Impeller tip dia/ tank dia	-	1/3 (approx)	1/3 (approx)	1/3 (approx)	1/3 (approx)	1/3 (approx)	1/3 (approx)	1/3 (approx)	1/3 (approx)
Notes										
1	There shall be complete re-suspension of all solids after a 24 hour outage. Accumulation of solids shall not prevent agitator restart.									
2	Agitation shall be provided to prevent settlement of slurry by side entry agitators . All the side-entry agitators shall be similar									
3	Maximum Sound Pressure Level at a height of 1.5 m above floor level in elevation, and at a distance of 1.0 m horizontally shall be 85 dBA.									
4	Although the height of all tanks is fixed above, same may vary slightly during detailed engineering as per design calculation of tanks.									
5	Normal solid particle size shall be used for design of all Agitators in tanks and sumps.									
6	Slope of roof shall be considered approximate 5 deg for all the tanks.									

Annexure-9

RAMAGUNDAM STPP FGD - AGITATOR PACKAGE

LIST OF COMMISSIONING SPARES (Required for Commissioning of Agitators)

Break up price for COMMISSIONING SPARES

Sl. no	Description	Qty.	Unit	Unit price	Total Ex-Works Prices duly packed	ED	CST	FREIGHT Inclusive Service Tax	Total price FOR SITE
	Total (Rs)								

NOTE -

1) Bidder shall furnish unit price of commissioning spares in above format along with the Bid. Any part even though not mentioned in list furnished but required at later date shall be supplied free of cost.

Annexure-10: Attachment-3k (of NTPC)-To be filled separately for horizontal and vertical agitators

FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE
FOR
LOT-3 PROJECTS
BIDDING DOCUMENT NO. CS-0011-109(3)-9

Bidder's Name and Address:

To
Contract Services-III
NTPC Limited
Noida-201301

Summary of Critical Equipment indicated under clause 4.01.00, sub-section-I, Part-A of Section-VI.

Equipment Name	Sub-Vendor Name	Collaborator's Name, if applicable	Seeking Qualification as per clause..... Sub-Section-I, Part-A of Section-VI
~~Booster Fans~~			~~*4.01.01 /*4.01.02 /*4.01.03~~
~~*Slurry Recirculation Pumps~~			~~*4.01.01 /*4.01.03 /*4.01.07~~
~~Oxidation Blowers~~			~~*4.01.01 /*4.01.03 /*4.01.04~~
~~Wet limestone Grinding mills~~			~~*4.01.01 /*4.01.03 /*4.01.05 (i)/ 4.01.05 (ii)~~
~~Slurry Pumps~~			~~*4.01.01/*4.01.03~~
Agitators			*1.2,*1.4,*1.7
~~Vacuum Belt filters~~			~~*4.01.01 /*4.01.03~~

Note : *Strike-off whichever is not applicable.

Signature of authorized signatory.....

1. If qualification sought as per clause *1.2 sub-section-I-A, Part-A of Section-VI then the details of the sub vendor (manufacturer) shall be filled by the bidder in the format A to G.

2. ~~If the qualification sought as per the clause 4.01.02, sub-section-I-A, Part-A of Section-VI, then the details of proposed sub vendor (i.e manufacturer of such equipment for at least *195/*250/*500//*660 MW unit rating) shall be filled individually by the bidder in the format A and the details of collaborator who meets the requirement stipulated at 4.01.01, sub-section-I-A, Part-A of Section-VI shall also be filled by the bidder in the format A separately. Further, in case of qualification vide clause 4.01.02, sub-section-I-A, Part-A of Section-VI a copy of valid ongoing collaboration and technology transfer agreement for design, engineering, manufacturing, supply of such equipment in India with the collaborator who meets the requirement stipulated at 4.01.01, sub-section-I-A, Part-A of Section-VI shall also be furnished.~~

3. If the qualification sought as per the clause *1.4 sub-section-I-A, Part-A of Section-VI then the details of JV/Subsidiary Company formed for manufacturing of such equipment in India shall be furnished individually for each equipment by the bidder such as,

   i) Copy of document of incorporation of JV/Subsidiary company in India

   ii) Copy of valid ongoing collaboration and technology transfer agreement for design, engineering, manufacturing, supply of such equipment in India with the collaborator who meets the requirement stipulated at *1.2, sub-section-I-A, Part-A of Section-VI.

   iii) Copy of document of at least 26% equity participation of qualified equipment manufacturer in the Indian JV company/subsidiary company directly or indirectly through its holding company /Subsidiary company, which shall be maintained for a lock -in period of seven (7) years from the date of incorporation of such JV/subsidiary or up to the end of defect liability period of the contract which ever is later.

   Further, the details of collaborator or technology provider of the qualified equipment manufacturer who meets the requirement stipulated at *1.2, sub-section-I-A, Part-A of Section-VI shall be filled by the Bidder in the format A to G (format given at 1.00.00). In addition to that, the sub vendor along with the Indian JV company/subsidiary company, qualified equipment manufacturer and its holding company/subsidiary company as applicable shall furnish the Letter of Support as per the format enclosed at Annexure-I.

*** strike out whichever is not applicable.**

1.00.00 (Applicable for Bidder/his sub vendors seeking qualification as per clause no. *1.2 , Sub section-I, Part-A of Section-VI. Bidder shall furnish the required data only for those equipments / auxiliaries which are proposed to be sourced under this route.)

Signature of authorized signatory.....

We, hereby furnish the data on proveness criteria for critical equipment, auxiliaries, systems and Bought Out Items such as ~~Booster Fans, *Slurry Recirculation Pumps, Oxidation Blowers, Wet Limestone Grinding Mills, Slurry Pumps~~, & Agitators which have been designed (either by self manufacturer or under valid ongoing collaboration and technology transfer agreement), *manufactured/ *got manufactured and supplied by us /Manufacturer (or manufactured/ got manufactured & supplied by our proposed sub-vendors) and these are in successful operation in at least one (1) plant for a period not less than one year reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder. The details of type and minimum equipment rating of such equipment are given below :

A. **For Booster Fans:** We declare that, we/our Sub-Vendor, have designed (either by itself or under collaboration / licensing agreement),*manufactured/*got manufactured and supplied at least one (1) number of Booster Fan of required flow & head of the offered Booster Fan with Fan Speed 900 rpm (maximum), Axial type with variable pitch control working in a Coal fired power plant and which has been in successful operation for minimum one(1) year reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder, as per the details furnished below:

Sl. No.	Description	Reference Work
1.	Name of the reference plant & location:	
2.	Client name and his address:	
3.	No. of units and capacity in MW of unit:	
4.	Whether equipment operating in a coal fired power plant	-*Yes/*No
5.	Name of equipment manufacturer & address:	

Signature of authorized signatory.....

F. **Agitators:** We declare that, we/our Sub-Vendor, have designed (either by itself or under collaboration / licensing agreement),*manufactured/*got manufactured and supplied at least one (1) number of Agitators with rating not less than that supplied for 500 MW or higher size unit for similar application, Vertical/Horizontal type working in Wet Limestone based FGD application in Coal fired power plant and which has been in successful operation for minimum one(1) year reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder, as per the details furnished below::

Sl. No.	Description	Reference Work
1.	Name of the reference plant & location:	
2.	Client name and his address:	
3.	No. of units and capacity in MW of unit:	
4.	Whether power plant is coal fired	-*Yes/*No
5.	Whether operating in a Wet Limestone based FGD application in coal fired power plant	-*Yes/*No
6.	Name of equipment manufacturer & address:	
7.	Date of commission of the equipments:	
8.	Model no. of the equipment:	
9.	Brief Technical particulars of the equipments:	
10.	Agitators supplied for	…….MW unit size

Signature of authorized signatory...

Sl. No.	Description	Reference Work
11.	Whether the equipment(s) are in successful operation in atleast one(01) plant for a period not less than one(01) year reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder	-*Yes/*No
12.	Flue gas Desulphurization system details:	*Technical extract/ *paper letter/ *email/ *Drwaing from user or *contract docu ment or *scheme or *any document in public domain enclosed at annexure....to Attachment-3K
13.	Scope of Work:	*Letter of Award or *Contract or *P.O. enclosed at Annexure.....to Attachment-3K
14.	Performance details:	*Certificate/*Letter/*E-mail from End user enclosed at Annexure.....to Attachment-3K

*** Strike off whichever is not applicable.**

Signature of authorized signatory.....

***7.00.00** **Applicable for Bidder/his sub vendors seeking provenness criteria as per clause no. *1.7 , Sub section-I, Part-A of Section-VI.**

7.01.00 We, hereby confirm that *we/*our sub-vendors is a manufacturer of a manufacturer of Agitators for similar process/duty application in petrochemical or metals and mining industry. (Details of references enclosed at Annexure ……)

(Data to be furnished in line with format given at 1.00.00 of this Attachment))

7.02.00 We further confirm that details in respect of collaboration / valid licencing agreement for the Agitator between *us/*our sub-vendors, as per 6.01.00 above, and with qualified Agitator manufacturer, who meets the requirement stipulated at clause *1.2 , sub-section-I, Part-A, Section-VI are enclosed at **Annexure-…..** to this Attachment. The data in respect of proveneness criteria for the qualified Agitator manufacturer, which is in successful operation in at least one (1) plant for a period not less than one reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder are furnished below.

We further confirm that before taking up the manufacturing of such Agitator, *we/ *our sub vendor(s) *will create /*have created manufacturing facilities at his works as per collaborator's/licenser's design, manufacturing and quality control system.

(Data to be furnished in line with format given at 1.00.00 of this Attachment)

Signature of authorized signatory.....

***3.00.00** **Applicable for JV Company/Subsidiary Company meeting provenness criteria as per clause no. *1.2, Sub section-IA, Part-A of Section-VI.**

3.01.00 We, hereby confirm that JV company/ Subsidiary company (Strike off whichever is not applicable) formed for manufacturing and supply of equipment(s) (~~*Booster Fans, *Slurry Recirculation Pumps, *Oxidation Blowers, *Wet Limestone Grinding Mills, *Slurry Pumps,~~ *Agitators, ~~*Vacuum Belt Filters~~) has a valid ongoing collaboration and technology transfer agreement for design, engineering, manufacturing of such equipment(s) in India with a qualified equipment manufacturer who meets the requirements stipulated at clause 4.01.01 of sub-section-I, Part-A, Section VI of bidding documents (or the technology provider of the qualified equipment manufacturer). Further, in such a case, such qualified equipment manufacturers is having, directly or indirectly through its holding company/subsidiary company, at least 26% equity participation in the Indian Joint Venture Company/subsidiary company, which shall be maintained for a lock-in period of seven (7) years from the date of incorporation of such Joint Venture / Subsidiary or up to the end of defect liability period of the contract, whichever is later. Before taking up the manufacturing of such equipment(s) (~~*Booster Fans, *Slurry Recirculation Pumps, *Oxidation Blowers, *Wet Limestone Grinding Mills, *Slurry Pumps,~~*Agitators, ~~*Vacuum Belt Filters~~), we/ our sub vendor(s) *will create /*have created manufacturing facilities at his works as per collaborator's/licenser's design, manufacturing and quality control system.

We further confirm that details in respect of collaboration / valid licencing agreement for the aforesaid equipment(s) (~~*Booster Fans, *Slurry Recirculation Pumps, *Oxidation Blowers, *Wet Limestone Grinding Mills, *Slurry Pumps,~~ *Agitators, ~~*Vacuum Belt Filters~~) who meets the requirement stipulated at clause ***1.2,** sub-section-I, Part-A, Section-VI for are enclosed at **Annexure-…….** to this Attachment.

Signature of authorized signatory.....

SECTION-B

PROVENNESS

The Bidder / Bidder's sub-vendor(s) is required to meet the provenness criteria and/or qualification requirement for the items/ services listed below as per the stipulated criteria indicated in the respective clauses. For the purpose of qualification of Bidders / Sub-vendor(s), experience shall be reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder unless otherwise specified in the respective clauses.

1.0 Provenness Criteria/Qualifying Requirements for Equipments/Systems

1.1 The Bidder / Bidder's sub-vendor(s) is required to meet the provenness criteria and/or qualification requirement for critical equipments, auxiliaries, systems and bought out items as per criteria stipulated below:

1.2 ~~Booster Fans, Slurry Recirculation Pumps, Oxidation Blowers, Wet Limestone Grinding Mills, Slurry Pumps~~, Agitators ~~& Vacuum Belt Filters~~ for the Wet Limestone based Flue Gas Desulphurisation (FGD) System offered by the Bidder shall be only from such manufacturer(s) who has previously designed (either by itself or under collaboration / licensing agreement), manufactured / got manufactured the respective equipment(s) of the type, application and minimum equipment rating as stipulated below such that the respective equipment(s) should have been in successful operation in at least one (1) plant for a period not less than one(1) year.

Type and Rating for Qualification

Sl. No.	Name of Equipment	Type of Equipment	Application	Equipment Rating
(a)	Booster Fans	Axial type with variable pitch control	Coal fired power plant	Unit size of 500 MW – Flow 490 m3/s (min.) with Head 400 mmwc (min.) & Fan Speed 900 rpm (max.)
				Unit size of 210 MW & Below – Flow 225 m3/s (min.) with Head 400 mmwc (min.) & Fan Speed 900 rpm (max.)
(b)	Slurry Recirculation Pumps	Centrifugal type	Wet Limestone based FGD application in Coal fired	Unit size of 500 MW & Above - Flow 10200 m3/hr (min.) with Head 16

Sl. No.	Name of Equipment	Type of Equipment	Application	Equipment Rating
			power plant	Meters of Liquid Column (min.)
				Unit size of 210 MW & Below – Flow 5680 m3/hr (min.) with Head 16 Meters of Liquid Column (min.)
(c)	Oxidation Blowers	Centrifugal/ positive displacement type blower	Wet Limestone based FGD application in Coal fired power plant or any other process application	Unit size of 500 MW & Above - Flow 7300 Nm3/hr Dry Basis (min.) with Head 8500 mmwc (min.) for spray tower process Or Head 3500 mmwc (min.) for bubbling type process
				Unit size of 210 MW & Below - Flow 5000 Nm3/hr Dry Basis (min.) with Head 6500 mmwc (min.) for spray tower process Or Head 3500 mmwc (min.) for bubbling type process
(d)	Wet limestone Grinding mills	Horizontal Wet Ball mill	Wet Limestone based FGD application in Coal fired power plant	Station size of 2001 MW – 2600 MW Capacity 40 T/hr (min.) with pulverizing fineness not less than 90% thru 325 mesh
				Station size of 1501 MW – 2000 MW - Capacity 30 T/hr (min.) with pulverizing fineness not less than 90% thru 325 mesh

Sl. No.	Name of Equipment	Type of Equipment	Application	Equipment Rating
				Station Size of 1000 MW -1500 MW Capacity 20 T/hr (min.) with pulverizing fineness not less than 90% thru 325 mesh
(e)	Slurry Pumps	Centrifugal type	Wet Limestone based FGD application or ash slurry application in Coal fired power plant	Unit size of 500 MW & Above - Flow 50 m3/hr (min.) with head 30 Meters of Liquid Column (min.)
				Unit size of 210 MW & Below - Flow 25 m3/hr (min.) with head 30 Meters of Liquid Column (min.)
(f)	Agitators	Vertical/Horizontal	Wet Limestone based FGD application in Coal fired power plant	Agitator rating not less than that supplied for 500 MW or higher size unit for similar application
(g)	Vacuum Belt filters	Belt type	Wet Limestone based FGD application in Coal fired power plant or in any other process application	Station size of 2001 MW- 2600 MW-Capacity 65 T/hr (min.)
				Station size of 1501 MW-2000 MW-Capacity 50 T/hr (min.)
				Station Size of 1000 MW – 1500 MW-Capacity 35 T/hr (min.)

The provenness criteria for equipment (Booster Fans) stipulated at Sl. No. 1.2 (a) above shall also be considered acceptable provided the rating parameters (i.e., flow, head and rated rpm) is covered within the operating regime of the respective fan performance curve of the reference plant equipment.

CLAUSE NO.	INTENT OF SPECIFICATION

The provenness criteria for equipment (Slurry Recirculation Pumps) stipulated at Sl. No. 1.2 (b) above shall also be considered acceptable provided the rating parameters (i.e., flow and head) is covered within the operating regime of the respective Slurry Recirculation Pump performance curve of the reference plant equipment.

1.3 In case the Bidder or the proposed sub-vendor is not manufacturer of proven Booster Fans as per clause 1.2 (a) above but is a manufacturer of such equipment for units of at least * MW rating, the Bidder or the proposed sub vendor shall be considered qualified for manufacturing such equipment for ** MW units also, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such equipment in India with such manufacturer who meets the requirements stipulated at clause 1.2 (a) above for the Booster Fans.

For value of * and ** refer table below.

*	**
195 MW	**195 MW – 500 MW**
500 MW	**660 MW**

1.4 A JV / Subsidiary Company formed for manufacturing and supply of equipment(s) as listed at clause no. 1.2 above in India, shall also be considered qualified for manufacturing such equipment(s), provided that it has a valid collaboration or licensing agreement for design, engineering, manufacturing of such equipment(s) in India with a qualified equipment manufacturer who meets the requirements stipulated at clause 1.2 above (or the technology provider of the qualified equipment manufacturer) for the respective equipment(s). Before taking up the manufacturing of such equipment(s), the bidder/ his sub-vendor(s) must create /have created manufacturing facilities at his works as per collaborator's/licenser's design, manufacturing and quality control system for such equipment(s).

Further, in such a case, such qualified equipment manufacturers should have, directly or indirectly through its holding company/ subsidiary company, at least 26% equity participation in the Indian Joint Venture Company/ Subsidiary Company, which shall be maintained for a lock-in period of seven (7) years from the date of incorporation of such Joint Venture/ Subsidiary or upto the end of defect liability period of the contract, whichever is later.

1.5 In case the Bidder or the proposed sub-vendor is not manufacturer of proven Oxidation Blowers as per clause 1.2 (c) above but is a manufacturer of Blowers/compressors for minimum 50 NM^3/min capacity, the Bidder or the proposed sub-vendor shall also be considered qualified for manufactur-ing Oxidation Blowers, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such Oxidation Blowers in India with such manufacturer who meets the requirements stipulated at clause 1.2 (c) above for the Oxidation Blowers. Before taking up the manufacturing of such equipment, the bidder/ his sub-vendor must create /have created manufacturing facilities at his works as per collaborator's /licenser's design, manufacturing and quality control system for such equipments.

CLAUSE NO.	INTENT OF SPECIFICATION
1.6	(i) In case the Bidder or the proposed sub-vendor is not manufacturer of proven Wet limestone Grinding mills as per clause 1.2 (d) above but is a manufacturer of dry Grinding mills for power or cement industry of minimum 20 T/h capacity, the Bidder or the proposed sub-vendor shall also be considered qualified for manufacturing Wet limestone Grinding mills, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such Wet limestone Grinding mills in India with such manufacturer who meets the requirements stipulated at clause 1.2 (d) above for the Wet limestone Grinding mills. Before taking up the manufacturing of such equipment, the bidder/ his sub-vendor must create /have created manufacturing facilities at his works as per collaborator's /licenser's design, manufacturing and quality control system for such equipments. In addition, the Bidder shall be required to furnish a letter of support from Collaborator(s) / Licensor / Technology provider for successful performance of the equipment valid up to the end of defect liability period of the contract as per the format enclosed in the bidding documents, at the time of placement of order on the approved sub-vendor. **OR**
1.6	(ii) In case, the bidder or proposed sub vendor is not a manufacturer of proven Wet Limestone Grinding Mills as per clause 1.2 (d) above, but have designed, manufactured & supplied dry Grinding Ball Tube mills for at least 500 MW pulverized coal fired power plant, the Bidder or the proposed sub-vendor shall also be considered qualified for manufacturing Wet limestone Grinding Mills provided it has a licensing agreement with a Wet limestone Grinding mills manufacturer who meets the requirements stipulated at clause 1.2 (d) above for the Wet limestone Grinding mills and provides extended warranty of three (3) years for the Wet Limestone Grinding Mills.
1.7	In case the Bidder or the proposed sub-vendor is not manufacturer of proven Agitators as per clause 1.2 (f) above but is a manufacturer of Agitators for similar process/duty application in petrochemical or metals and mining industry, the Bidder or the proposed sub-vendor shall also be considered qualified for manufacturing Agitators, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such Agitators in India with such manufacturer who meets the requirements stipulated at clause 1.2 (f) above for the Agitators. Before taking up the manufacturing of such equipment, the bidder/ his sub-vendor must create /have created manufacturing facilities at his works as per collaborator's /licenser's design, manufacturing and quality control system for such equipments.
1.8	In case the Bidder or the proposed sub-vendor is a manufacturer of Slurry Pumps who meets the requirements stipulated at clause 1.2 (e) above, the Bidder or the proposed sub-vendor shall also be considered qualified for manufacturing Slurry Recirculation Pumps, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such equipment in India with such manufacturer who meets the requirements stipulated at clause 1.2 (b) above for the Slurry Recirculation Pumps. Before taking up the manufacturing of such equipment, the bidder/ his sub-vendor must create /have created manufacturing facilities at his

CLAUSE NO.	INTENT OF SPECIFICATION
	works as per collaborator's /licenser's design, manufacturing and quality control system for such equipment.
1.9	Before taking up the manufacturing of such equipment(s) as per clause 1.3, 1.4, 1.5, 1.6(i), 1.7 & 1.8 above, the Bidder / its sub vendor(s) must create (or should have created) manufacturing and testing facilities at its works as per Collaborator / licenser's design, manufacturing and quality control system for such equipments duly certified by the Collaborator / licensor. Further, the Collaborator / Licenser shall provide (or should have provided) all design, design calculation, manufacturing drawings and must provide (or should have provided) technical and quality surveillance assistance and supervision during manufacturing, erection, testing, commissioning of equipments.
1.10	Bidder shall offer and supply only the type of the above equipment(s) for which it, itself or the manufacturer / Collaborator(s) / Licenser(s) proposed by the Bidder for the above equipment(s) is qualified.
1.11	The Employer reserves the right to fully satisfy himself regarding capability and capacity of Bidder / its sub-vendor(s) and the proposed arrangement and may prescribe additional requirement before allowing manufacture of the equipment listed above for this contract.
	Note to clause 1.2 (1) Whenever the term 'coal fired' is appearing above, "Coal" shall be deemed to also include bituminous coal/brown coal/Anthracite Coal/lignite.
2.0	**Sub QR for Civil Works:**
2.1	Bidder or its agency should have in past executed civil and structural works for * or higher capacity (applicable for project having ** MW unit rating) coal based/Lignite based power plant including earthwork in filling involving mechanical compaction and cutting in hard rock, piling, foundations, Bulk material handling plant involving underground storage hopper and underground tunnels.
2.2	Bidder can engage more than one agency, in case the Bidder itself is not able to meet the requirement at 2.1. The agency being engaged for a particular work should have in the past executed such works of * or higher capacity plant (applicable for project having ** MW unit rating).
2.3	For Chimney, Bidder or its agency should have in the past built at least one (1) reinforced concrete chimney of minimum 100m height.

RAMAGUNDAM STAGE I & II (3X200 MW + 3X500 MW)						Rev-00, Date: OCT 2021
ANNEXURE-V: GUARANTEED POWER CONSUMPTION FORMAT						
Technical Specification No. PE-TS-467-571-18000-A002						
Sl.No.	**Description / Item**	**Working**	**Standby**	**Power Consumption (KW) (at motor input terminal)**	**Duty Factor**	**Power Consumption (KW)**
1	**2**	**3**	**4**	**5**	**6**	**7 = 3 x 5 x 6**
A)	**Limestone slurry storage tank agitataor**	**2**	**0**	To be filled by Bidder	**1**	To be filled by Bidder
B)	**Primary hydro-cyclone feed tank agitator**	**1**	**0**	To be filled by Bidder	**1**	To be filled by Bidder
C)	**Secondary hydrocyclone feed tank agitator**	**1**	**0**	To be filled by Bidder	**1**	To be filled by Bidder
D)	**Filtrate water Tank Agitator**	**1**	**0**	To be filled by Bidder	**1**	To be filled by Bidder
E)	**Waste Water Tank Agitator**	**1**	**0**	To be filled by Bidder	**1**	To be filled by Bidder
F)				**Total Guaranteed power (KW)**		To be filled by Bidder
Notes						
1	Power consumption (KW) of motors shall be measured at motor input terminals when the system operating at the rated capacity.					
2	Total Estimated Power Consumption Figure for the above mentioned Agitators is considered as 189 KW which is to be treated as base power. Declared Guaranteed Power Consumption in this Format duly signed and stamped shall be submitted along with technical bid. Total GPC given by the bidder shall not exceed 189 kW failing which offer of bidder will not be considered for evaluation.					
3	Total power (@ S.No. F above) and not individual power quoted by bidder shall be termed as 'Guaranteed Power consumption' (GPC) and bidder shall be liable to demonstrate compliance to GPC value during PG test/ Demonstration test at site. If the actual power consumption exceeds 189 kW , liquidated damages shall be payable by the successful bidder at the rate of INR 249478/- per KW excess power consumption over 189 kW. Such liquidated damages may be recovered by the BHEL by deduction from the contract price or by enforcing the contract performance guarantee or in any other manner deemed fit by the BHEL. Acceptable short fall limit for GPC WITH LD will be (+1%) of base power (189 kW).					