TECHNICAL SPECIFICATION

FOR

LIMESTONE GRINDING SYSTEM

CONFIDENTIAL

CUSTOMER	**: NTPC Limited**
PROJECT	**: MOUDA 2x500MW TPS**
APPLICATION	**: FLUE GAS DESULPHURIZATION SYSTEM**

BHARAT HEAVY ELECTRICALS LIMITED
(A GOVT OF INDIA UNDERTAKING)
Flue Gas Desulphurization Group
Ranipet

TECHNICAL SPECIFICATION FOR WET BALL MILL SYSTEM

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Revision – 00 Dated 25/05/2019		COMMENTS :	

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1.0 PROJECT INFORMATION:

Mouda Super Thermal Power Project (2x500 MW), a pit head coal based thermal power project, is located in Nagpur district of Maharashtra State. Basic inputs i.e. coal, water and land have already been tied up. The capacity of the project is 1000 MW comprising of two (2) units of 500 MW each

a.	Owner	NTPC
b.	Buyer	BHEL, Ranipet
c.	Process/Application	Flue Gas Desulphurization

A) SITE CONDITIONS

1.	**Ambient Temperature and Relative Humidity**		
a.	**Site Condition**		
	Ambient Temperature(Guarantee point)	:	27 deg C
	Ambient Temperature (Design)	:	45 deg C
	Relative Humidity	:	60 %

Note:

1) Guarantee point site conditions shall apply for the Guarantee Values as well as for the Guarantee test/Performance test

2) Equipment and Material must be suitable for the range of ambient site conditions

B) PROJECT LOCATION AND APPROACH

The power project is located near Mouda in Nagpur district in the state of Maharashtra.

a.	Country	**India**
b.	State/Division	**Maharashtra**
c.	District	Nagpur

2.0 APPLICABLE CODES & REGULATIONS

The design and materials shall conform to the requirements of applicable codes and regulations of the latest edition. The design, manufacture, installation and testing of the Limenstone Grinding System/Wet Ball Mill System shall follow the latest applicable Indian/International (AISI / ASME/EN/Japanese) Standards. GB standards are not acceptable.

3.0 INTENT OF SPECIFICATION

This specification covers the minimum requirements for the complete design, material, manufacturing, shop inspection, testing at the manufacturer's works, supervision of erection & commissioning and performance guarantee testing of Limestone Grinding System along with accessories which is furnished in the Flue Gas Desulphurization plant of 2 x 500 MW FGD systems. The following points may be noted.

a. There are 2 units of each 500 MW and each unit is envisaged with one FGD system. The FGD system will be provided with common limestone grinding system (LGS). 2 numbers of Wet

Ball Mill (1 working + 1 standby) shall be provided. This WBM system shall be located inside the Ball Mill Building. Building is in BHEL scope.

b. Bidder shall assume full unit responsibility for the entire equipment assembly and make all possible efforts to comply strictly with the requirements of this specification and other specifications/attachments to inquiry/order.

c. The Bidder shall offer only proven design which meets the Provenness criteria indicated in the **Annexure-I** . Necessary document evidences as per **Annexure-3K for qualification** shall be submitted along with the bid. If bidder doesn't meet the specified provenness criteria, they are denied to participate in this tender.

d. In case, deviations are considered essential by the Bidder (after exhausting all possible

Efforts), the same shall be separately listed in the Bidder's proposal under separate section, titled as "List of Deviations/Exceptions to the Enquiry Document (**Annexure-IV**)".

e. Any deviation, not listed under the above section, even if reflected in any other portion of the proposal, shall not be considered applicable.

f. No deviation or exception shall be permitted without the written approval of the purchaser.

g. Compliance to this specification shall not relieve the Bidder of the responsibility of furnishing equipment and accessories/auxiliaries of proper design, materials and workmanship to meet the specified start up and operating conditions.

h. In case, the Bidder considers requirement of additional instrumentation, controls, safety devices and any other accessories/auxiliaries essential for safe and satisfactory operation of the equipment, the same shall be recommended along with reasons in a separate section and include the same in scope of supply.

i. All accessories, items of work, though not indicated but required to make the system complete for its safe, efficient, reliable and trouble free operation and maintenance shall also be in supplier's scope unless specifically excluded.

4.0 PROVENNESS CRITERIA:

The Bidders are required to meet the Qualification Requirement (QR) for Wet Ball Mill system as per **Annexure-I & submit the Annexure to qualification requirement (Annexure-3K). Bidders offers will be rejected if they fail to meet the QR**

5.0 TECHNICAL INFORMATION

GENERAL DESCRIPTION OF LIMESTONE GRINDING SYSTEM

The purpose of this system is to grind lump limestone of Size 25 mm (Max) to powder and for preparation of limestone slurry. The duct from the limestone silo hopper feeds the limestone to the gravimetric feeder. The Gravimetric feeder feeds limestone to Wet ball mill system. The Wet Ball Mill system consists of Wet Ball Mill, Wet Ball Mill Lubrication system, Mill circuit tank with an agitator, Mill circuit Pump, Mill Hydro cyclone , 3-way distributor and acessories. The Wet Ball Mill is the wet horizontal type. The Process water is supplied to Wet Ball Mill and Wet Mill receiver Tank. Slurry from the Wet Ball Mill flows by gravity to the Wet Mill Receiver Tank and then is pumped up to the Mill Hydro cyclone to be classified. The Mill Hydro cyclone underflow containing the oversized material is re-circulated to the Wet Ball Mill inlet directly, while the overflow is discharged to the Limestone Slurry storage Tank via the 3 -way distributor as a product of Wet Ball Mill system

S. No	Description	Requirement		
1.	**Quantity**			
	Quantity of Wet Ball Mill system	2 No's (1 working + 1 standby)- common system		
2.	**Parameters**			
	WBM Design capacity	20 TPH		
	Medium to be handled	Limestone		
	Limestone Analysis	Refer Clause 5.1		
	Type of WBM system	Horizontal		
	Duty	Continuous		
	Location	Inside Building		
3.	**POWER SUPPLY**			
	The following voltage levels shall apply:			
	3.3 kV ±6%,50 Hz	:	Voltage for motors equal to / bigger than 200KW and for power distribution within the plant.	
	415 V ±10%, 50Hz		Standard voltage for power supplies to small electric power consumers and motors below 200 KW lighting and domestic	
	Bidder shall design and supply the equipment suitable for satisfactory operation under above mentioned power supply condition. HT motor is in BHEL scope.			

5.1 LIMESTONE ANALYSIS/CHARACTERISTICS

S.No	Description	Unit	Parameters
1.	**CaO**	Wt%	47-51.0
2.	**MgO**	Wt%	0.9-2.0
3.	**Fe_2O_3**	Wt%	0.45-1
4.	**Al_2O_3**	Wt%	1.19-2.1
5.	**Si_2O_3**	Wt%	2.1-4.5
6.	**Mn_2O_3**	Wt%	<0.12
7.	**P_2O_5**	Wt%	Traces
8.	**Cl_2**	Wt%	<0.015
9.	**Na_2O**	Wt%	<0.16
10.	**K_2O**	Wt%	<0.01
11.	**TiO_2**	Wt%	<0.02
12.	**Total Sulphur**	Wt%	<0.1
13.	**LOI**	Wt%	39.0-41.3
14.	**Bond index**	KWh/Sh.t	13.0
15.	**Lump size**	**mm**	25 mm at Ball Mill inlet
16.	Limestone Bulk Density	**Kg/m3**	1400 kg/m3 for volumetric computation - 1700 kg/m3 for torque / drive / structural load computation

5.2 WATER ANALYSIS

The following water to be used during the grinding process of limestone in Wet Ball Mill (WBM) system.

S.no	Constituents	Unit	PROCESS WATER
1.	Total cations as $CaCO_3$	Ppm	1859
2.	Total anions as $CaCO_3$	Ppm	1859
3.	Calcium as $CaCO_3$	Ppm	858
4.	Magnesium as $CaCO_3$	Ppm	616
5.	Sodium plus Potasium as $CaCO_3$	Ppm	330
6.	Iron as Fe	Ppm	1.65
7.	Total alkalinity as $CaCO_3$	Ppm	1210
8.	Chlorides as $CaCO_3$	Ppm	412.5
9.	Sulphate as $CaCO_3$	Ppm	236.5
10.	Silica	Ppm	137.5
11.	Ph		7.0 – 8.2
12.	Turbidity	NTU	55

5.3 COOLING WATER ANALYSIS

The following Demineralized Cooling water (DMCW) will be used for cooling (if applicable). Cooling water supply line and return line will be terminated by BHEL at single point in Limestone Grinding building. Further piping is in bidder's scope.

S.No	Constituents	Unit	Water quality
1.	pH		9 to 9.5
2.	Temperature	Deg C	38
3.	TDS	Ppm	Minimal
4.	Pressure	MPaG	<0.4
5.	Maximum Allowable Temperature increase	Deg C	5 to 10 Deg C
6.	Maximum Allowable Pressure Drop.	Kg/cm^2	$\leq 1.0\ Kg/cm^2$

5.4 INSTRUMENT AIR ANALYSIS

The following Instrument Air will be used for the system operation and will be terminated by BHEL at single pointin Limestone Grinding building. Further piping is in bidder's scope.

		Available Value			Design Value		
		Minimum	Normal	Maximum	Minimum	Normal	Maximum
Temperature	Deg.C	-	-	-	-	45	-
Pressure	MPaG	-	-	-	0.55	-	0.8

6.0 SCOPE OF SUPPLY

Scope for the bidders shall include Design, Engineering, Manufacturing, Packing, Supply, Supervision of Erection & Commissioning, Performance Guarantee Test and handing over of final Customer (NTPC).

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

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

Supervision of Erection & commissioning: Includes supervision of erection & commissioning, supervision of trial operation, PG test, training of customer's O&M Personnel and handing over to customer.

Each mill system shall be supplied by separate distribution box. The scope of supply for **Limestone Grinding System** shall include but not limited to the following:

Sl no	Item Description	Quantity per Mill	UNIT	Vendor to confirm
1.	Chute from lime stone silo hopper bottom to feeder	1	NO	
2.	Inlet rod gate at gravimetric feeder inlet	1	NO	
3.	Knife gate valve at gravimetric feeder inlet with electric actuator (with integral starters - non-intrusive type, SIL2 certified)	1	NO	
4.	Gravimetric feeder along with its drives and other accessories (complete assembly)	1	SET	
	i. All connection chute with proper liner			
	ii. All connection bolts/nuts/washers for installation			
	iii. Required instruments and any safety device			
	iv. Fully closed type with opening door			
5.	Facility for unloading the limestone silo, through feeder, to a truck at ground level along with all necessary chutes/diversion chutes and gate valve	1	SET	
6.	Knife gate valve (KGV) below the gravimetric feeder outlet chute. (actuator with integral starter; nonintrusive type SIL2 certified)	1	NO	
7.	Chute from gravimetric feeder to ball mill inlet	1	NO	
8.	Wet ball mill complete (with all accessories)	1	SET	
	i. Horizontal Ball Mill and Speed reducer			
	ii. Auxiliary motor for inching operation with speed reducer, Clutch system			
	iii. All coupling for connecting main motor to reducer, inching motor to clutch and reducer, and reducer to pinion.			
	iv. Lubrication system with all piping and piping supports (Piping Supports and piping design is supplier's scope of supply)			
	v. Mill Shell, Feed Head, Discharge Head			
	vi. Local Panel with emergency push button for control			
	vii. Water cooling for lubrication system and gearbox			
	viii. Dumpster or Drum (Ball and limestone rejects)			
	ix. Ball Charging Hopper			
	x. All interconnecting extended drain pipe and chutes			

	xi. Support Beam (Inlet chute, Ball charge chute (Piping), etc.)			
	xii. Provision for Vibration Monitoring system			
	xiii. Initial Ball charge			
	xiv. Anchor Bolts and Nuts			
	xv. Base frames wherever applicable (including HT Motor base frame)			
	xvi. Ball charging device (Tripping Device)			
9.	Mill separator tank with all nozzles as per P&ID	1	SET	
10.	Mill tank agitator with IE3 motor and gear box	1	SET	
11.	Mill circuit pump with IE3 motor	2	SET	
12.	Mill hydro cyclone and complete accessories	1	SET	
	i. Hydro cyclone clusters			
	ii. Anchor bolts, nuts and washers			
	iii. Companion flanges for inlet and overflow			
	iv. A variety size of vortex finders for all the hydro cyclone			
	v. Accessory piping within the skid			
13.	Distribution box with pneumatic actuator	1	SET	
14.	All coupling for connecting main motor to reducer, inching motor to clutch and reducer, and reducer to pinion.	1	SET	
15	Bearing lubrication system of	1	SET	
	a) LP/HP (both pump 2x100%)			
	b) 3 Heaters & oil tank with 2x100% duplex filter			
	c) Oil cooling system			
	d) SS pipes & valves to supplied as per vendor design			
	e) Jet lubrication system to ring gear & pinion			
16	Foundation bolts, anchor bolts, nuts for entire system	1	SET	
17.	Complete base frame including drive motor base frame	1	SET	

18.	Butterfly valves as per P&ID with Nonintrusive type Electrical actuator -SIL2 certification	As per P&ID	NOS	
19.	Butterfly valves as per P&ID with manual actuator	As per P&ID	NOS	
20.	Butterfly valves as per P&ID with pneumatic actuator (OC)	As per P&ID	NOS	
21.	Pneumatic regulating flow control valves as per P&ID	As per P&ID	NOS	
22.	Pressure transmitter(PT) as per P&ID with root valve	As per P&ID	NOS	
23.	Pressure indicator (PI) With root valve/diaphragm	As per P&ID	NOS	
24.	Pressure gauge with root valve	As per P&ID	NOS	
25.	Expansion joint at inlet and discharge of the pumps	4	NOS	
26.	Flow transmitter (FT)	As per P&ID	NOS	
27.	Flow Indicator control (FIC)	As per P&ID	NOS	
28.	Weight indicator (WT)	As per P&ID	NOS	
29.	Weight indicator Control	As per P&ID	NOS	
30.	Level transmitter (LT)	As per P&ID	NOS	
31.	Level Indicator Control Alarm	As per P&ID	NOS	
32	Vortex flow meter()	As per P&ID	NOS	
33	Temperature element at ball mill bearing (TE)	6	NOS	
34	Local control panel with interlock logics	1	SET	
35	Complete pipping as per P&ID: a. Water line b. Slurry line c. Instrument airline d. Pump flushing line, e. Tank over flow, & Drain piping valve f. All drain piping	1	SET	
36	Complete erection and assembly drawing	2	SET	
37	Density meter/mass flow meter(Coriolis Meter)	1	NO	

38	All instruments/ transmitter shall be provided along with Junction Boxes	1	SET	
39	Mechanical seal flushing globe valve, any other valves not covered above	As per P&ID	SET	
40	All motors shall be provided with suitable double compression cable gland	1	SET	
41	Temporary strainers for the Mill circuit pump	2	SET	
42	Any other valves/instruments which are required for operation and maintenance of the system, shall considered by the vendor while submitting the offer (list of items shall be submitted along with offer)	1	SET	
43	Painting and Rust Prevention during shipment and construction	1	SET	
44.	Export packing and Inland Transportation	1	SET	
45.	Supervision of Erection & commissioning at site	1	SET	
46.	Performance Test and Inspection at shop/site	1	SET	
47.	Special tools & tackles as applicable	1	SET	
48.	Start-up & Commissioning spares as applicable	1	SET	
49.	Installation, operation and maintenance manuals	1	SET	
50.	Bidder to quote for the Mandatory Spares) with breakup price.	-	-	
51.	Any other items required for completeness of the equipment except the items covered in the exclusions.	1	SET	
NOTE: Bidder shall refer to the P&ID diagram for details. All the utility pipes (water pipes , instrument air, etc) are provided at single point near to limestone ball mill building. Bidder has to further take the piping from the point terminated by BHEL.				

6.1 PROCESS DATA

Stream no	<1>	<2>	<3>	<4>	<5>	<6>	<7>
Fluid	**Lump limestone**	**Limestone ball mill over flow**	**Hydro cyclone feed**	**Hydro cyclone underflow return**	**Process water to ball mill**	**Process water to mill tank**	**Limestone product slurry**
Total flow m^3/h	-						
Total flow kg/h	**20000**						
Temp °C	45				45	45	
Solid wt.%	100				0	0	30
Solid comp wt.% $CaSO_4.2H_2O$ $CaCO_3$ **Fly ash Other Total**	As per cl. no. 5.1				-	-	As per cl. no. 5.1
pH	--				7.0 – 8.2	7.0 – 8.2	
Cl^- mg/l as $CaCO_3$	--				412.5	412.5	

Note: Bidder to fill the blank data and submit along with offer

7.0 DESIGN REQUIREMENT

S.No	Description	Vendor to confirm
1.	All connecting pipes / chutes, pipe supports, trestles, valves, motor (other drives) etc. along with necessary valves from chute to mill and from hydro-cyclone to common slurry storage tanks and wherever required within the system shall be in the scope of the supplier.	
2.	Descriptions in the drawings, in the documents, and in the displays shall be in English	
3.	Any item not included above but necessary for safe and reliable operation of the milling system proposed by the supplier shall also be in the suppliers' scope.	
4.	The equipment shall be designed to withstand the corrosive and moist environment in which these are proposed to operate.	

5.	Noise level produced by any rotating equipment individually or collectively shall not exceed a) 90 dBA for ball mill and b) 85 dBA for all other equipment's like pumps, feeder, etc., Noise level measured at a distance of 1.0 meters from the source in any direction and 1.5m above operating floor. Predicted sound pressure levels for the WBM drive assemblies shall be submitted as part of the proposal data.	
6.	The overall vibration level shall be as per ISO 10816.	
7.	Suitable drain connections shall be provided.	
8.	The equipment shall be suitable for stable operation continuously.	
9.	All connecting pipes / chutes, pipe supports, trestles, valves, motor (other drives) etc. along with necessary valves from chute to mill and from hydro-cyclone to common slurry storage tanks and wherever required within the system shall be in the scope of the supplier.	
10.	Descriptions in the drawings, in the documents, and in the displays shall be in English	
11.	Any item not included above but necessary for safe and reliable operation of the milling system proposed by the supplier shall also be in the suppliers' scope.	
12.	The equipment shall be designed to withstand the corrosive and moist environment in which these are proposed to operate.	
13.	The overall vibration level shall be as per ISO 10816.	
14.	Suitable drain connections shall be provided.	
15.	The equipment shall be suitable for stable operation continuously.	
16.	Suppliers shall suitable specify their delivery schedule along with the offer and Standard code specified shall be strictly adhered.	
17.	All instruments such as pressure transmitters, density transmitters (especially at hydro-cyclone outlet), and other necessary transmitters wherever necessary shall be supplied by the suppliers	
18.	Supplier shall provide the loading of item and other factors which shall be required for effective civil construction.	
19.	Tanks, pumps, hydro-cyclone etc. are to be designed by vendor based on their experience considering the required milling capacity of each Ball Mill System	
20.	**CHUTES:** Silo opening size: 500 mm x 500 mm Minimum clear cross section of chute: 500 mm x 500 mm (inside both ways). Minimum clear cross section of Discharge debris chute: 500mm X 500mm (inside both ways)	

21.	Limit of connection: The buyer (BHEL) has an intention to minimize interface for utilities as much as possible. The bidder shall consider this requirement in the planning stage of layout for the equipment. The bidder shall provide the header piping for WBM and branch piping to each nozzle. Terminal points for all utilities shall be located at skid edge. The bidder shall specify all terminal points with tie-in number in the P&ID and submit it in the proposal to confirm the scope of supply.	
22.	Service life: Entire equipment except wearing parts shall be designed and fabricated for a minimum service life of 30 years of operation or 200,000 full load operating hours whichever is longer.	
23.	Corrosion allowance: Corrosion allowance for entire equipment shall be in accordance with latest applicable Indian / International standard.	
24.	Unless otherwise specified , flanges shall be in accordance with ANSI B16.5 Class 150	
25.	Name plate: All equipment shall be provided with nameplates indicating the item number and service name. Name plates shall be of 304 Stainless steel plate and placed at a readily visible location. Nameplate of main equipment shall have enough information, which will be confirmed during engineering phase. Stainless steel nameplates for all instruments and valves shall be provided.	
26.	Rotation arrows shall be cast in or attached with stainless steel plate on each item of rotation equipment at a readily visible location.	
27.	Unless otherwise specified, all equipment items where the weight exceeds 15 kg shall be provided with suitable lifting lugs, ears or ring bolts or tapped holes for lifting rings. Minimum shock factor for lifting lugs shall be minimum 2.0. The position of lifting lugs and reference dimension shall be shown on GA and/or outline drawings. NDT shall be conducted for lifting lugs. When any spreader bars are required for lifting and laydown, the bidder shall provide spreader bar with equipment.	
28.	Skid Mount/Transportation: Equipment shall be fabricated as skid mount design as much as practical to minimize erection at the site.	
29.	Two pieces of stainless steel earth lugs shall be provided with equipment diagonally. The position of earth lugs shall be shown on each GA and/or outline drawing.	
30.	Provide double nuts for anchor bolts	
31.	Bidder shall provide allowable vibration level on foundation in foundation drawings and/or general arrangement drawings.	
32.	If the driver/driven equipment train is in the resonance condition or any vibration problems occur, the bidder shall solve the problems in a timely manner.	
33.	Bidder shall provide the mating flanges with the necessary gaskets.	
34.	All the surfaces of the carbon steel should be rust prevented before shipment for the period of at least 12 months for storage and construction.	
35.	Bidder to provide capacity of crane or hoist required for material handling and the details of heaviest component to be handled.	

36.	The list of all Bought out items with makes and country of origin to be mentioned along with offer to be submitted.	
37.	Quality Plan to be submitted along with the offer.	
38.	Cost towards the participation in discussions/meetings, providing technical assistance during technical discussions/meetings with customer for approval of drawing/documents etc. TA/DA, boarding and lodging to attend these meetings shall be borne by the bidder and shall be inclusive in supply portion.	
39.	Material of construction for all equipment/components shall be subject to NTPC/ BHEL approval during detail engineering. Accordingly, bidder shall consider MOC for all equipment/component as per best engineering practice, global standard and global references. Material of construction shall be as per Indian and international standards (ASTM/ANSI/EN/JIG/ISO/AISI) only	
40.	Bidder to provide sub vendor list and Bidder shall strictly adhere to NTPC approved vendor list. In case bidder proposes an additional vendor for an item or vendor approval is required for any new item, acceptance shall be subject to approval by NTPC/ BHEL before placing order and bidder shall submit relevant documents as per Attachment-XX-sub-supplier questionnaire attach.	
41.	It shall be the complete responsibility of the successful bidders to obtain "Sub Vendor Approval" from BHEL / NTPC for all equipment's & components. Any delay in sub vendor's approval should not affect the project schedule. If any of the sub vendors does not have the approval of NTPC/ BHEL, the same may be replaced with another NTPC/BHEL approved sub-vendor only, without any price implications to BHEL.	
42.	The modalities of inspection (Stage, Final, In-process) shall be finalized during detail engineering after submission of quality assurance plan (QAP). It shall be reviewed by the NTPC/ BHEL. Bidder shall follow the procedures of inspection as per the approved QAP. Bidder has to submit the following documents along with inspection call and if any other documents required as per approved QAP. - Raw material inspection certificate - Internal test reports - Statutory certificates as required. - All inspection & testing shall be carried out based on the following documents: a. Relevant Standards b. Specifications c. Approved drawings d. Data Sheets e. Calibration certificate for all the measuring instruments f. Bidder should also coordinate in getting the MDCC's (Material Dispatch clearance certificate) and all types of IC's (Inspection Certificates) from the NTPC along with BHEL.	
43.	Minor Chipping i.e. up to 50 mm thk, micro leveling and providing shim plates for erection of	

	equipment / item at site shall be in the scope of bidder.	
44.	During detail engineering, bidder to strictly adhere to BHEL/NTPC drawing formats, document numbering, quality plan & FQP formats	
45.	The identification and numbering of equipment, systems, items, etc. of supply, as well as of all documents and drawings shall be in accordance with reference Designation System for Power Plants - KKS system.	
46.	Complete detail engineering drawings, calculations, selection of components etc. shall be reviewed & subject to approval of BHEL/NTPC during detail engineering	
47.	Bidder shall furnish necessary inputs & drawings of all equipment in editable Auto CAD/ MS-Word /Excel format.	
48.	During detail engineering, successful bidder shall ensure flow of drawings/documents as per schedule. Any comments from BHEL/NTPC should be addressed timely by the bidder.	
49.	Bidder to note that list above is not exhaustive and any work /items required for completing the smooth operation and ensuring satisfactory running of the machines till final hand over to the end user (NTPC) shall also be in the scope of the bidder.	
50.	Bidder shall submit the signed and stamped copy of all the pages which constitutes this technical enquiry specification signed by authorized signatory and clearly mentioning each clause under following two categories to avoid any ambiguity in scope understanding & the scope division along with technical offer. a. “Accepted without deviation and considered in scope of work” b. “Not considered in scope of work”	
8.0	**DESIGN AND CONSTRUCTION**	
8.1	CHUTE	
a.	The minimum valley angle of chutes shall be 60 degrees from horizontal. Transfer chutes shall be adequately sized and sloped to ensure smooth flow of Lime without any accumulation anywhere.	
b.	Chutes shall be made of minimum 20 mm thick TISCRAL / SAILHARD/ LSLAS07 or equivalent or fined with SS304 material. All chutes should have one inspection door at every floor and for the ones in between the floors (more than 1.5 meter above the operating floor level) suitable access for trouble free maintenance shall be provided. For sealing of inspection doors labyrinth type arrangement to be provided.	
c.	Complete chute work in the region of flap gates shall be fabricated from 20 thk TISCRAL or equivalent. In case of vertical chute (valley angle more than 80 degree) complete chute, work shall be of 20 mm thick TISCRAL or equivalent material. While finalizing the chute work inside the building, arrangement for shifting and replacing chute legs, proper handling arrangement/wall openings, trolleys, hoists shall also be provided. While fabricating the chute, no welds in between shall be allowed.	

d.	**Ball Mill Chute:** g. Feed chute shall be corrosion resistant metal lined and designed to prevent overflow. h. Inlet chute shall have necessary provisions for loading balls into the ball mills, such as ball charging hopper. A discharge chute shall be provided with necessary provisions to collect and separate balls and tramp metal.	
8.1	**CHUTE BLOCKAGE SWITCHES**	
a.	One no. chute blockage switch of proven type (subject to approval of the employer) shall be provided	
b.	Chute blockage switch shall trip the feeding conveyor in case of Chute blockage and protect the feeding conveyor equipment.	
8.2	**SILO SHUT OFF GATE VALVE**	
a.	A bunker outlet chute shall be provided for feeding limestone from bunker to the feeder. The size of the opening chute shall be sufficient to ensure proper flow of the limestone. There shall be no reduction of section in the bunker outlet chute from bunker to feeder. The inlet chute shall be provided with suitable poke doors/holes in order to remove jamming/blockage. A manual and motorized bunker shut-off gate shall be provided at the inlet to each feeder	
b.	All parts of the gate in contact with limestone shall be of stainless steel construction.	
c.	The shut-off gates and its actuator shall ensure 100% closing of the gate even with 'bunker full of limestone'.	
d.	Facility shall be provided to open/close the bunker outlet gate, through actuator, from remote as well as local (integral starter)	
e.	In addition, a hand wheel with proper access shall also be provided for manual operation of the gate. The force at the rim of the hand wheel shall not exceed 35 kg with bunker full of limestone.	
f.	For each bunker facilities shall be provided for unloading the bunker, through feeder, to a truck at ground level, along with all necessary chutes and diversion chutes.	
8.3	**GRAVIMETRIC FEEDER**	
	a. Gravimetric feeders(closed type) shall be sized to meet 110% of the maximum mill capacity. b. The limestone feeder belt shall be of seamless rubber construction. It should be possible to adjust the belt tension from outside without opening the feeder body. c. All parts in contact with limestone except belt shall be of stainless steel construction. d. The feeder shall have adequate instrumentation to detect 'loss of flow'. e. The feeder shall have a motor/pneumatic operated gate at the outlet.	

<table>
<tr><td>8.4</td><td>WET BALL MILL</td><td></td></tr>
<tr><td>a.</td><td>There shall be two numbers wet Ball mills for grinding of limestone, each mill shall be sized to meet the following conditions, all occurring together.

<table><tr><td>Capacity</td><td>20 Tons Per Hour (TPH)</td></tr><tr><td>Input Limestone Size</td><td>1” (max.) – 25 mm</td></tr><tr><td>Output Fineness</td><td>30wt% slurry with Output Fineness 90% or higher through 325 mesh</td></tr><tr><td>Mill Wear Part</td><td>Conditions Near Guaranteed Wear Part Life.</td></tr><tr><td>Limestone bond index</td><td>13 (min) kWh/sh.T)</td></tr></table></td><td></td></tr>
<tr><td>b.</td><td>The limestone ball mill shall produce ground limestone slurry at a rate of 20 ton/hr (dry basis) with particle sized 90% passing through 325 mesh. The wet ball mill shall be of the wet horizontal type and shall be furnished complete with drive system including speed reducer and Inching Drive, gear lubrication system, bearing lubrication system, all accessories and all required instrumentation to furnish a complete functioning ball mill.</td><td></td></tr>
<tr><td>c.</td><td>Ball mills shall be designed to accept the following streams concurrently; dry limestone feed, process water and recycle stream of oversized limestone slurry.</td><td></td></tr>
<tr><td>d.</td><td>Ball mill shall be fabricated of heavy structural quality welded steel plate. All shell welds shall be full penetration welds.</td><td></td></tr>
<tr><td>e.</td><td>Each mill shall have an outlet spout that is opposite of the inlet chute.</td><td></td></tr>
<tr><td>f.</td><td>Head, trunnion and shells shall be per the Bidder's standards. The main shaft shall be forged alloy steel and shall be equipped with heavy duty, precision type which are designed to provide reliable and trouble free operation. The design shall ensure that thrust is not transmitted through the gear reducer, shaft and coupling to the motor.</td><td></td></tr>
<tr><td>g.</td><td>The mill shell shall include two (2) inspection doors with a minimum size. The inspection doors shall be sized to admit the largest liner segment or discharge grate. The openings shall be hinged (if possible) and shall be equipped with watertight seals and bolted enclosures.</td><td></td></tr>
</table>

h.	The mills shall be designed and constructed with adequate strength and rigidity to ensure true alignment of the shell and trunnion bearings. Shell shall be bolted to the shell, using an external flange design. Head and shell shall be drilled for liners prior to shipment. The discharge shall be provided with a trommel screen.	
i.	All internal parts that may require replacement shall be designed to be easily dismantled and replaced without necessity of removing the mill or its drive from the foundations.	
j.	Water-jacketed inserts shall be included for bearing cooling, if necessary. The pedestal and cap shall be of welded steel fabrication with inspection doors in the caps. Sole plates shall be adjustable.	
k.	Vibration shall be minimized.	
l.	Temperature sensors (with transmitter, dual type, instrument box) shall be provided on each ball mill bearing to provide indication of bearing temperature.	
m.	A local emergency stop switch shall be provided for all motors(Bidder's Scope) in mill system	
n.	The local control station (with emergency stop switch/ local/remote, etc.) shall be provided for each inching drive.	
o.	Ball mill shall be completely shop assembled, aligned and operated in so far as possible. Components shall be match marked after shop assembly to assure proper assembly in the field.	
p.	Mill Liners - All wetted surface except for ball and trommel grate shall be rubber lined. - All rubber linings shall be done in strict accordance with the rubber Manufacture is inspection and applicable codes and standards. - Mill liners shall be attached by through bolts with leak proof washers.	
q.	Ball Mill Drives - Each ball mill shall be furnished with speed reducing gear driver and inching drive. Speed reducer shall be provided with a flexible, spacer type, coupling and guard. Mill gear and pinion shall be of Spur design. Ball Mill Motor is in BHEL Scope of supply.	
r.	Grinding Balls - The Bidder shall furnish a complete ball charge for each mill. - The Bidder shall provide in the data for frequency, procedures and equipment for ball removal, screening of undersized balls, and ball charging. - The Bidder shall provide the ball consumption rate versus limestone hardness in his offer. - Bidder shall also guarantee ball consumption per ton of limestone throughput.	
s.	All integral auxiliaries of the mills like hydro-cyclones, separator tank & mill circuit pumps shall be sized to meet the above conditions (a). A 100% stand-by pump shall be provided for the mill circuit pump.	
t.	The mill hydro-cyclone set shall have sufficient redundancy. A minimum 10% spare Hydro-cyclone shall be provided in each set of hydro-cyclone. Hydro-cyclones shall be of modular construction. It shall be possible to remove and replace individual hydro-cyclone with the set in service. Individual isolation valve shall be provided for each hydro-cyclone for this	

	purpose. The hydro-cyclone shall be of proven design and shall be provided with replaceable rubber lining. The hydro-cyclone shall be provided with replaceable rubber lining of thickness 12 mm for the feed chamber and 12 mm for the overflow launder. The liners shall have a minimum wear life of not less than 8000 hrs.	
u.	All parts of the mill including mill body, trunnion, hydro-cyclones, integral pipes, mill circuit pumps and other parts in contact with limestone slurry shall be provided with replaceable rubber wear liners. The wear liners or wear parts shall have a minimum guaranteed wear life of not less than 8000 hrs without reversal of the liners. The guaranteed capacity and fineness of the mill shall not be affected within the guaranteed life of the mil wear parts.	
v.	The material of the balls shall be chosen to ensure that the balls do not lose their original shape and to ensure minimum ball consumption. The contractor shall also guarantee ball consumption per ton of limestone throughput. The contractor shall furnish the minimum ball diameter below which the balls shall be replaced.	
w.	Facility shall be provided for on-load loading of steel balls to the mill.	
x.	The ball mill shall be driven by a motor through a peripheral gear/ central drive system. An auxiliary motor shall also be provided for inching of mills after trip and during maintenance.	
y.	The lube oil system shall have 100% stand-by arrangement for lube oil pumps and oil coolers of each circuit with independent pump / cooler and tank. Wherever required duplex oil filters shall be provided.	
z.	The mill auxiliaries like separator tanks, mill circuit pump, hydro-cyclones and all connecting pipes handling limestone slurry shall have replaceable rubber linings.	
aa.	Piping and wiring within the skid should be in the vendor's scope.	
bb.	Local control panel shall have display on the front panel and necessary electrical parts.	
8.5	**WET BALL MILL WEAR PARTS GUARANTEE**	
a.	All parts of the mill including mill body, HP & LP trunnion, hydro-cyclones, integral pipes, mill circuit pumps and other parts in contact with limestone slurry shall be provided with replaceable rubber wear liners. The wear liners or wear parts shall have a minimum guaranteed wear life of not less than **8000 hrs.** Without reversal of the liners. The guaranteed capacity and fineness of the mill shall not be affected within the guaranteed life of the mil wear parts.	
b.	The material of the balls shall be chosen to ensure that the balls do not lose their original shape and to ensure minimum ball consumption. The supplier shall also guarantee ball consumption per ton of limestone throughput. The supplier shall furnish the minimum ball diameter below which the balls shall be replaced	

8.6	**WET BALL MILL BALL CONSUMPTION**	
a.	Supplier shall furnish the minimum ball diameter below which the balls shall be replaced. Each mill shall be sized to meet the following conditions, all occurring together.	
8.6	**MILL CIRCUIT TANK**	
a.	The slurry preparation tank shall be CS construction with replaceable rubber lining. The storage tanks shall be equipped with sufficient number of agitators, to avoid settling.	
b.	All the slurry tanks shall be designed, fabricated, erected and tested in accordance with the IS:803, latest edition. Additional Corrosion allowance of 1.5mm on the minimum tank shell thickness as calculated by IS:803, latest edition shall be provided by the Contractor	
c.	Tanks shall be made from IS:2062 quality mild steel plates of tested quality. The tanks shall be of welded construction.	
d.	Interior surface of the tanks shall lined with replaceable chlorobuty/bromobutyl rubber lining of minimum 5 mm thickness and the outside surface shall be coated with paint as approved by the Employer. The Tanks shall be provided with drain, manholes, over flow & inlet level control valves etc. Suction screens shall be installed to protect the pumps. Bidder shall source rubber lining work from proven supplier.	
8.7	**MILL CIRCUIT PUMPS**	
a.	Quantity: 2 No's for <u>each</u> limestone grinding system (Total 4 numbers)	
b.	Margins: Flow 10% (minimum) Head 15% (minimum)	
c.	Solids Concentration Max. 55% by weight or actual as per suppliers practice, whichever is minimum.	
d.	The Contractor shall offer only proven design in successful operation in similar application at previous installations. The design, manufacture, installation and testing of the pumps shall follow the latest applicable Indian / International (ASME /EN/ Japanese) Standards.	
e.	The pumps shall be designed for continuous operation. The pump shall be single stage centrifugal type capable of delivering the rated flow at rated head with margins as specified in the respective clauses.	
f.	The slurry concentration in the pump shall not exceed 55% by weight.	
g.	All the slurry pumps shall be provided with motorized suction and discharge valves. In addition, flushing water lines with motorized valves shall be provided for each pump for automatic flushing of the pump after each shut down. The flushing water for the pumps shall be taken form the process water supply	

h.	In case of pump with rubber lined casing, the casing should be radially split to allow easy removal of impeller.	
i.	All the pump wear parts in contact with the slurry shall be provided with replaceable rubber/elastomer liners suitable for the fluid handled. The Bidder can also offer an hi chrome alloy line pump if the Bidder has previous experience of the same for similar applications. The material used by the contractor shall be proven in previous installations.	
j.	The material and thickness of the liners shall ensure a minimum service life of 2 years before replacement. All the wear parts of the pump shall be guaranteed for a minimum wear life of not less than 14000 hrs.	
k.	The design of the shaft shall ensure that the operating speed is at least 20% above the critical speed of the shaft.	
l.	The pump shall be provided with seals of proven type and seal type shall be flushless .The shaft shall be supported on heavy duty ball/roller bearings.	
m.	Design and construction of various components of the pumps shall conform to the following general specifications. For material of construction of the components, data sheets shall be referred to.	
	a) Pump Casing	
	Pumps shall be Radial Split Casing, Close/Semi-open, Over-hang, End Suction type Back Pull-out design, Vertical Discharge type for Horizontal Centrifugal Pump. The casing shall be designed to withstand the maximum shut-off pressure developed by the pump at the pumping temperature. Pump casing shall be provided with a vent connection and piping with fittings & valves. Casing drain as required shall be provided complete with drain valves, piping and plugs. It shall be provided with a connection for suction and discharge pressure gauge as standard feature. It shall be structurally sound to provide housing for the pump assembly and shall be designed hydraulically to minimum radial load at part load operation.	
	b) Impeller	
	Impeller shall be closed, semi-closed or open type as specified elsewhere and designed in conformance with the detailed analysis of the liquid being handled. The impeller shall be secured to the shaft, and shall be retained against circumferential movement by keying, pinning or lock rings. On pumps with overhung shaft, impellers shall be secured to the shaft by a lockout or cap screw which tightness in the direction of normal rotation.	
	c) Impeller/Casing Wearing Rings	
	Replaceable type wearing rings shall be provided at suitable locations of pumps. Suitable method of locking the wearing ring shall be used. Wearing rings shall be provided in pump casing and/or impeller as per manufacturer's standard practice.	
	d) Shaft	
	The critical speed shall be well away from the operating speed and in no case less than 130% of the rated speed. The shaft shall be ground and polished to final	

	dimensions and shall be adequately sized to withstand all stresses from rotor weight, hydraulic loads, vibration and torques coming in during operation.	
	e) Shaft Sleeves	
	Renewable type fine finished shaft sleeves shall be provided at mechanical seals. Shaft sleeves shall be fastened to the shaft to prevent any leakage or loosening. Shaft and shaft sleeve assembly should ensure concentric rotation.	
	f) Bearings	
	Heavy duty bearings, adequately designed for the type of service specified in the enclosed pump data sheet and for long, trouble free operation shall be furnished. The bearings offered shall be capable of taking both the radial and axial thrust coming into play during operation. In case, sleeve bearings are offered additional thrust bearings shall be provided. Antifriction bearings of standard type, if provided, shall be selected for a minimum life 20,000 hrs. of continuous operation at maximum axial and radial loads and rated speed. Proper lubricating arrangement for the bearings shall be provided. The design shall be such that the bearing lubricating element does not contaminate the liquid pumped. Where there is a possibility of liquid entering the bearings suitable arrangement in the form of deflectors or any other suitable arrangement must be provided ahead of bearings assembly. Bearings shall be easily accessible without disturbing the pump assembly. A drain plug shall be provided at the bottom of each bearings housing.	
	g) Mechanical Seals	
	Mechanical seals shall be of single type with either sliding gasket or bellows between the axially moving face and shaft sleeves or any other suitable type. The sealing faces should be highly lapped surfaces of materials known for their low frictional coefficient and resistance to corrosion against the liquid being pumped.	
	The pump supplier shall coordinate with the seal maker in establishing the seal chamber of circulation rate for maintaining a stable film at the seal face. The seal piping system shall form an integral part of the pump assembly. For the seals under vacuum service, the seal design must ensure sealing against atmospheric pressure even when the pumps are not operating. Seals shall be fleshless type.	
	h) Pump Shaft Motor Shaft Coupling	
	The pump and motor shafts shall be connected with an adequately sized flexible coupling of proven design with a spacer to facilitate dismantling of the pump without disturbing the motor. Necessary coupling guards shall also be provided.	
	i) Base Plate	
	A common base plate mounting both for the pump and motor shall be furnished. The base plate shall be fabricated steel and of rigid construction, suitably ribbed and reinforced. Base plate and pump supports shall be so constructed and the piping unit so mounted as to minimize misalignment caused by mechanical forces such as normal piping strain, internal differential thermal expansion and hydraulic piping thrust. Suitable drain troughs and drip lip shall be provided.	

8.8	**MILL CIRCUIT TANK AGITATOR**	
a.	Mill circuit tank agitator shall be of top entry (vertical) type. The design of the agitators shall be of proven type. The shaft of the agitators shall be of Carbon steel with rubber lining with a minimum life of 2 years. Blades shall be of Alloy 926 or better material	
b.	Agitators shall be supplied in tanks and vessels to prevent caking and settlement of particles out of the slurry.	
c.	Standard type agitators with suitable characteristics shall be used wherever practical. The agitators shall be complete with motor, gearbox, agitator shaft, coupling, safety guards, mechanical seal (for side entry agitators), impeller, support legs, agitator mounting flange including bolts nuts and gasket etc..	
d.	All agitator parts and accessories in contact with the stirred fluid shall be constructed of materials specifically designed for the conditions and nature of the stirred fluid and be resistant to erosion and corrosion	
e.	Each agitator and its associated equipment shall be arranged in such a manner as to permit easy access for operation, maintenance and agitator removal without interrupting plant operation.	
f.	To prevent mechanical blocking load start-up after standstill of pumps, piping and agitators for slurries shall be applied with C-hose connection.	
g.	Lifting lugs and eyes and other special tackle shall be provided as necessary to permit easy handling of the agitators and their components.	
h.	Static and dynamic (as far as applicable) balancing of all agitators shall be carried out after assembly.	
i.	All agitator parts and components shall be designed and calculated for fatigue life, considering maximum bending loads, induced by fluctuating hydraulic forces and torsional loads, based on the installed motor power. For side entry agitators the alternating bending moment resulting from impeller and shaft weight has to be considered additionally.	
j.	All exposed moving parts shall be covered by guards.	
k.	agitator shall be flange mounted.	
l.	The shape of the impeller blades of top entry agitators shall be designed to avoid wear on the impellers which will affect the agitator performance as specified for a minimum period of 2 years of continuous operation under design conditions for the range of coal & limestone specified in the specification. In order to avoid excessive wear impeller tip speeds must not exceed 12 m/s.	
m.	Belt drives (if applied) shall be properly designed to provide a minimum lifetime of 2 years under design conditions.	
8.7	**PIPING / VALVES**	
a	The limestone slurry pipes shall be sized to minimize erosion and avoid settling of the	

	limestone at part load operation. The slurry pipes shall be lined with replaceable rubber lining of minimum 6 mm thickness. Slurry pipes shall be designed to keep the velocity above the settling velocity under all operating conditions. The supplier may provide a recirculation line with motorized isolation valve for the above purpose.	
b	All the pipes handling slurry shall be provided with replaceable rubber lining or FRP of proven quality. The Supplier can provide slurry pipes of size lower than 3" made up of FRP material (Sic coating on slurry exposed surface) if bidder has proven experience of the same.	
c	The isolation valves provided in all the slurry lines shall be of knife gate type/butterfly type. Motorized actuators shall be provided for valves requiring frequent operation as indicated in the relevant scheme.	
d	The valves shall be of proven type and the supplier shall submit a detailed valve schedule for employer's approval. Reference list for previous installations for similar application shall also be furnished to the employer	
e	The isolation valves shall be of knife gate type with rubber seats designed to prevent accumulation of solids on the valve seat.	
f	Supplier shall provide all necessary arrangements for purging & flushing of all the process pipelines, equipment's etc.	
h	Material of construction for pipe & valves shall be as mentioned in enclosed P & ID and as per specification enclosed in Annexure-XII- Pipe & valves spec	
8.10	**HYDROCYCLONE**	
a.	The hydro cyclone classification system shall be provided to classify the limestone slurry to the specified size. Overflow from the hydro cyclone shall be gravity fed by distribution piping to the limestone storage tank. The underflow shall be recycled back to the ball mill for further grinding	
b.	Total no. hydro-cyclone – 2 No's; 1 no (100%) per grinding system.	
c.	Mill hydro cyclone may be of polyurethane. Hydro-cyclone shall be of modular construction and designed for 100% of inlet feed. It shall be possible to remove and replace individual hydro-cyclone with the set in service. Individual isolation valve shall be provided for each hydro-cyclone for this purpose. The hydro-cyclone shall be of proven design and shall be provided with replaceable rubber lining of thickness 12 mm for the feed chamber and 12 mm for the overflow launder. The liner shall have a minimum wear life of not less than 8000 hours	
d.	The mill hydro-cyclone set shall have sufficient redundancy. A minimum 10% spare hydro-cyclone shall be provided in each set of hydro cyclone.	
e.	All parts of the hydro-cyclones, integral pipes, mill circuit pumps and other parts in contact with limestone slurry shall be provided with replaceable rubber wear liners.	
8.11	**MOTOR**	

	▪ Above 0.2 kW and upto 200 kW: 3 phase 415 V AC-VENDOR SCOPE ▪ Above 200 kW and upto 1500 kW: 3.3 KV- BHEL SCOPE ▪ Above 1500 kW: 11 KW-BHEL SCOPE All the continuous duty motor shall be of premium Efficiency class (IE3). For motor specification, bidder shall refer to Annexure- Xi Motor performance Bidder to submit the motor datasheet as per format given in the specification. Motor shall be sourced only from NTPC approved sources.	
8.12	JUNCTION BOX	
	Bidder to refer to the specification given in Annexure- XI	
8.13	**INSTRUMENTS**	
	All instruments shall be as per specification enclosed in Annexure XI. Vendor to supply all the instruments as given in the P&ID.	
8.14	**POWER, CONTROL CABLE & INSTRUMENTATION CABLE**	
	All the control cables and instrumentation cable shall be as per specification enclosed in Annexure-XI Cable specification	
8.15	**LOCAL CONTROL PANEL:**	
	Each equipment shall be furnished with required instrumentation and electrical accessory devices mounted and connected in a control cabinet. A PLC based local control panel for the entire Limestone grinding System shall be supplied by the bidder. Bidder shall provide the control logic for the entire system. Provisions shall be made for the interface between the local cabinet and the DCS such that the operation of the equipments can be controlled from the control console in the FGD Control room.	
9.0	**PACKING AND FORWARDING**	
1.	Proper packing to be ensured. Indigenous Supply: WBM & sub system assembly shall be wrapped in polythene bags & packed in a strong rigid wooden crate. Rain water should not enter into the WBM internals during storage in the outer yard of power plant. Imported Supply: All imported supply should be packed as per Sea worthy packing standards Annexure - VI. All imported items should have Sea worthy packing. Liberal packing materials and struts shall be provided to arrest rolling and to protect from transit damages.	
2.	Equipment and process materials shall be packed and semi-knocked down, to the extent possible, to facilitate handling and storage and to protect bearings and other machine surfaces from oxidation. Each container, box, crate or bundle shall be reinforced with steel strapping in such a manner that breaking of one strap will not cause complete failure of packaging. The packing shall be of best standard to withstand rough handling and to provide suitable protection from tropical weather while in transit and while awaiting erection at the site. All the major equipments shall be supplied in steel crates. The package shall be supplied	

	in containers and it should be suitable for storage in the outside yard of the plant for a minimum period of 12 months.	
3.	Equipment and materials in wooden cases or crates shall be properly cushioned to withstand the abuse of handling, transportation and storage. Packing shall include preservatives suitable to tropical conditions. All machine surfaces and bearings shall be coated with oxidation preventive compounds. All parts subject to damage when in contact with water shall be coated with suitable grease and wrapped in heavy asphalt or tar impregnated paper.	
4.	Crates and packing material used for shipping will become the property of owner (NTPC)	
5.	Packaging or shipping units shall be designed within the limitations of the unloading facilities of the receiving ports and the ship will be used. It shall be the bidder's responsibility to investigate these limitations and to provide suitable packaging and shipping to permit transportation to site.	
6.	Packing (tare) shall be part of the equipment cost and shall not be subject to return. The packing should ensure integrity and cohesiveness of each delivery batch of equipment during transportation. In case of equipment assemblies and unit's delivery in the packing of glass, plastics or paper the specification of packing with the material and weight characteristics are to be indicated.	
7.	Each package should have the following inscriptions and signs stenciled with an indelible ink legibly and clearly: a. Destination b. Package Number c. Gross and Net Weight d. Dimensions e. Lifting places f. Handling marks and the following delivery marking	
8.	Each package or shipping units shall be clearly marked or stenciled on at least two sides as follows. **National Thermal Power Corporation NTPC** **MOUDA 2 X 500 MW.** **MAHARASTRA INDIA** **EPC CONTRACTOR: BHARAT HEAVY ELECTRICALS LIMITED, INDIA"** In addition, each package or shipping unit shall have the symbol painted in red on at least two sides of the package, covering one fourth of the area of the side.	
9.	Each part of the equipment which is to be shipped as a separate piece or smaller parts packed within the same case shall be legibly marked to show the unit of which it is part, and match marked to show its relative position in the unit, to facilitate assembly in the field. Unit marks and match marks shall be made with steel stamps and with paint.	
10.	Each case shall contain a packing list showing the detailed contents of the package. When any technical documents are supplied together with the shipment of materials no single	

	package shall contain more than one set of such documents. Shipping papers shall clearly indicate in which packages the technical documents are contained.	
11.	The case number shall be written in the form of a fraction, the numerator of which is the serial number of the case and the denominator the total number of case in which a complete unit of equipment is packed.	
12.	Wherever necessary besides usual inscriptions the cases shall bear special indication such as "Top", "Do not turn over", "Care" , "Keep Dry" etc. as well as indication of the center of gravity (with red vertical lines) and places for attaching slings (with chain marks)	
13.	Marking for Safe handling: To ensure safe handling, packing case shall be marked to show the following: a. Upright position b. Sling position and center of Gravity position c. Storage category d. Fragile components (to be marked properly with a clear warning for safe handling)	
14.	Each crate or package is to contain a packing list in a waterproof envelope. All items are to be clearly marked for easy identification against the packing List. All cases, packages etc. are to be clearly marked on the outside to indicate the total weight where the weight is bearing and the correct position of the slings are to bear an identification mark relating the to the appropriate shipping documents. All stencil marks on the outside of cases are either to be made in waterproof material or protected by shellac or varnish to prevent obliteration in transit.	
15.	**The packing slip shall contain the following information: -** Customer name, Name of the equipment, Purchase Order number with Date, Address of the delivery site, Name and Address of the Sender, Serial Number of WBM & accessories, BHEL item Code, Gross Weight and Net weight of Supplied items.	
16.	Prior to transport from manufacturer's work to destination, components of the unit shall be completely cleaned to remove any foreign particles. Flange faces and other machined surfaces shall be protected by an easily removable rust preventive coating followed by suitable wrapping.	
17.	All necessary painting, corrosion protection & preservation measures shall be taken as specified in painting schedule. Supplier shall consider the coastal environment zone which is defined as "very severe" during final finishing/shipping.	
18.	Successful bidder shall furnish the detail packing /shipment box details with information like packing box size, type of packing, weight of each consignment, sequence no. of dispatch, no. of consignment for each deliverable item against each billing break up units/ billable blocks. Without these details the BBU shall not be approved during detail engineering. Also, complete billing break-up with above mentioned details shall be submitted within 10days of LOI.	
19.	All items/equipment shall be dispatched in properly packed condition (i.e. no item shall be dispatched in loose condition such that it becomes difficult to store/identify its location at site at a later stage).	

20.	Cases which cannot be marked as above shall have metal tags with the necessary markings on them. The metal tags shall be securely attached to the packages with strong steel binding wire. Each piece, Skid, Case or package shipped separately shall be labelled or tagged properly.	
10.0	**SUPERVISION OF ERECTION, TESTING AND COMMISSIONING**	
1.	The erection of Limestone Grinding System (LGS) will be done by owner as per Erection Manual and check List. However, the bidder shall make one visit per boiler for the supervision of erection, pre-commissioning & post- commissioning check-up, start-up, testing and trial runs of all the items covered under the scope of supply.	
2.	There will be one visit per grinding system totally there will be 2 visits. The bidder will be informed well in advance for the visit. Bidder shall include 15 working days per visit in the offer with minimum 2 visits.	
3.	TA/DA, boarding and lodging shall be borne by the bidder and shall be inclusive in supervision charges portion.	
11.0	**EXCLUSION**	
	The following work associated with the WBM will be by others: a. Supply of main drive HT motor b. Civil foundations c. Walkways, platforms and ladders d. Element handling hoists	
12.0	**INSPECTION AND TESTING**	
A)	**Minimum Testing requirements to be considered are as below:**	
1.	Vibration levels measured on the non-rotating parts shall not exceed the zone limit “B” as defined in ISO 10816 at steady conditions and shall not exceed the zone limit “C” as defined in ISO 10816 at transient conditions.	
2.	List of Non-Destructive test over and above the material test are as follows: a. Mechanical Seal- Manufacturer’s recommendation. b. Base Plate- Stress relieving of weld. c. Replaceable Rubber liner- Shore Hardness, Class and Type certificate	
3.	Once mounting is finished and operation test will be conducted on each WBM to determine the characteristic curves. to determine the parameters at the design point, mechanical running & performance testing shall be performed & witnessed.	
4.	Vibration test and Noise level test shall be witnessed at site.	

5.	For surfaces with rubber lining Welding shall be visually inspected to verify the absence of rough area and unacceptable transition between surfaces which prevent the adequate adherence of rubber. The acceptance criteria shall be as per latest standard.	
6.	For surfaces with rubber lining, degree of cleaning shall be visually checked before the application of the coating. There must be no area with oxidation, dirt or partially or generalized corrosion defects.	
7.	Test certificates shall be issued for each lot of raw material used in the coating, corresponding to specific weight and traction resistance.	
8.	For surfaces with rubber lining, adherence test shall be conducted on production samples. Adherence test shall be conducted on the actual surface through hammering. In order to verify the absence of air packets (or) surface without adherence.	
9.	For surfaces with rubber lining, Coating thickness shall be checked at 100%.A High voltage porosity test will be conducted on 100 % of the coated surface.	
10.	Wear resistant parts shall be UT/RT tested to check soundness after suitable heat treatment. Check for chemical composition, hardness and microstructure shall be carried out.	
11.	Wet ball mill shells shall be statically balanced.	
B)	**General Inspection requirements to be considered are as below:**	
1.	Bidder shall furnish written copies of shop production, fabrication and quality test procedures and drawings to be used for review by BHEL / NTPC prior to manufacture. Inspection of above mentioned tests by BHEL/ NTPC representative at bidder's works is envisaged.	
2.	Ball Mill	
	Raw material for shaft, coupling, gears and pinions, Mill Heads ,top and bottom races and other rotating components shall be subjected to UT & Base frame for MPI. MPI/LPI shall be carried out to check surface soundness. Rubber wear lining of Mill Shell shall be checked for shore hardness. For Central driven ball mill shall be run tested (without grinding media) for 30 min at shop to check unusual noise and vibration.	
	Butt welds in the tube/separator/body casing of the mill shall be tested by RT and MPI. All other welds in main tube/separator shall be tested by MPI/LPI for acceptance. The tube shall be statically balanced	
	All gearboxes shall be run tested for adequate duration to check rise in oil temperature, noise level and vibration. Check for leak tightness of gear case also shall be performed.	
	All WBMs will be inspected at the Bidder's works before dispatch or where the test facilities are available.	
3.	**Feeders**	

	Any welds in the casing/pulley fabrication shall be checked with MPI.	
	Routine tests shall be done as per relevant Indian Standards or equivalent International Standards	
	All major items like plates for casing, head pulley, tail pulley, pulley shaft and major castings shall be procured with respective material test certificates	
	Calibration check shall be carried out on all feeders	
4.	**PIPING, VALVE**	
	All pipes and fittings shall be tested as per applicable code.	
	All valves shall be hydraulically/Air tested for body, seat and back-seat (if applicable) as per relevant standard.	
	NDT on valves shall be as per relevant standard	
	Valves shall be offered for hydro test in unpainted conditions.	
	Functional checks of the valves for smooth opening and closing shall also be done.	
5.	**TANKS**	
	All welds joints shall be DP tested and complete tanks shall be water fill tested.	
	All atmospheric storage tanks fabricated and erected at site shall be subjected to tests (water fill test, NDT and Vacuum box test) according to design code as applicable	
	Rubber lining shall be tested for hardness and spark test, as applicable.	
6.	**PUMPS**	
	UT on shaft forgings (greater or equal to 40mm) and MPI/DPT shall be done on shafts and impeller to ensure freedom from defects.	
	The pump casing shall be hydraulically tested at 200% of pump rated head or at 150% of shut off head, whichever is higher. The test pressure shall be maintained for at least half an hour.	
	The pump rotating parts shall be subjected to static and dynamic balancing.	
	All pumps shall be tested at shop for capacity, head efficiency and brake horse power at rated speed as per relevant/applicable standard.	
	Noise and vibration shall be measured during the performance testing at shop.	
7.	**Agitators**	
	Rubber lining shall be tested for hardness and spark test	

	Impellers shall be tested for dimensional and balancing check	
	Gear Boxes shall be tested for run test as per standard practice	
8.	The Bidder shall furnish performance test procedure along with standard. The test procedure will be reviewed and approved by the BHEL/NTPC.	
9.	wet ball mill shell shall be statically balanced.	
10.	The Bidder shall conduct performance test for the remaining WBM and submit the reports.	
11.	Acceptance tolerance of actual versus guaranteed performance for capacity, head, efficiency and power absorbed shall be as per applicable standard.	
12.	Vibration levels shall be measured during shop running/performance tests.	
13.	Contract shaft seals shall be used during shop tests, unless the seal design is unsuitable for the shop-test condition.	
14.	WBM shall not be released for shipment, until shop tests data and performance tests curves have been approved by Owner.	
15.	Bidder should furnish performance guarantee as per applicable standard guarantee for the design, manufacture, material and safe operation of the equipment's.	
16.	BHEL shall witness the test at Bidder's works and a notice of minimum three (3) weeks shall be given for attending the inspection.	
17.	Bidder to arrange all calibrated gauges, Instruments during inspection.	
18.	Mechanical running and the performance test shall be carried out. Bidder to arrange Motor of same / higher rating for the shop test and inspection.	
19.	The performance test may be carried out using water at shop and shall be converted to the design Conditions. In case of order placed on foreign vendors(i.e supplies from outside India), vendor has to finalize Inspection agency from the List enclosed in Annexure 'VII' at their own cost and carry out inspection as per the approved Quality plan. 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 our review and acceptance.	
13.0	**PAINTING**	
	Painting scheme given below is tentative. The painting details shall be finalized during contract stage:	
13.1	**Limestone Mill – Outside surfaces**	
	SURFACE PREPARATION: Blast cleaning to Sa 2½	
	PAINT | **Total DFT(µm min)**	

	PRIMER	**Primer**: Two coats of Epoxy resin based Epoxy Zinc phosphate primer to IS 13238 DFT- 50µ/coat (Total DFT µm min=100) **Intermediate:** One coat of Two component epoxy based intermediate paint pigmented with MIO/Tio2 DFT- 100µm min)	100 100
	FINISH	**Finish:** One coat of Epoxy based finish paint to IS 14209, DFT- 75µ/coat **Finish:** One coat of acrylic aliphatic polyurethane paint to IS 13213, DFT- 25µ/coat	75 25
	TOTAL DFT IN (µm min)		300
13.2	**Lime stone mill- Inside surfaces**		
	SURFACE PREPARATION: Blast cleaning to Sa 2½ (Near white metal) with surface profile 40-60µm conforming to ISO 8501-1		
	PAINT		
	PRIMER	**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 ASTMD520-00	***70***
	FINISH	-	**-**
	TOTOAL		***70***
13.3	**Process water pipe accessories**		
	SURFACE PREPARATION: Power Tool Cleaning to St3 (SSPC-SP3)		
	PAINT		

	PRIMER	**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	**Finish**: Two coats of synthetic Enamel to IS 2932, DFT-50µm/coat **Shade:** Grey white RAL 9002 **Identification tag:** Sea green shade no: 217 as per IS 5	***100***	
		TOTAL	***210***	
13.4	**Slurry Pipe Accessories**			
	SURFACE PREPARATION: Power Tool Cleaning to St3 (SSPC-SP3)			
		PAINT		
	PRIMER	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 whiteRAL 9002 Identification Tag: Sea Green Shade no: 217 as per IS 5	***100***	
		TOTAL	***210***	
13.5	**Service Air pipe accessories**			
	SURFACE PREPARATION: Power Tool Cleaning to St3 (SSPC-SP3)			
		PAINT		
	PRIMER	**Primer**: Two coats of Epoxy resin based Epoxy Zinc phosphate primer to IS 13238 DFT- 50µ/coat (DFT µm min=100) **Intermediate:** One coat of Two component epoxy based intermediate paint pigmented with MIO/Tio2 *DFT- 100µm min)*	***100*** ***100***	

	FINISH	**Finish:** One coat of Epoxy based finish paint to IS 14209, DFT- 75µ/coat **Finish:** One coat of acrylic aliphatic polyurethane paint to IS 13213, DFT- 25µ/coat	***75*** ***25***
		TOTAL	***300***
13.6	**Instrument air pipe accessories**		
	SURFACE PREPARATION: Power Tool Cleaning to St3 (SSPC-SP3)		
		PAINT	
	PRIMER	**Primer**: Two coats of Epoxy resin based Epoxy Zinc phosphate primer to IS 13238 DFT- 50µ/coat (DFT µm min=100) **Intermediate:** One coat of Two component epoxy based intermediate paint pigmented with MIO/Tio2 *DFT- 100µm min)*	***100*** ***100***
	FINISH	**Finish:** One coat of Epoxy based finish paint to IS 14209, DFT- 75µ/coat **Finish:** One coat of acrylic aliphatic polyurethane paint to IS 13213, DFT- 25µ/coat	***75*** ***75***
		TOTAL	***300***
13.7	**Valves and fittings (Temp <95 deg C)**		
	SURFACE PREPARATION: Power Tool Cleaning to St3 (SSPC-SP3)		
		Paint	
	PRIMER	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	***60***
	FINISH	Synthetic Enamel to IS 2932 Shade: Grey white RAL 9002 (Two coats)- 30µ/ coat	***60***
		TOTAL	***120***

14.0	**SPARES,TOOLS & TACKLES**	
14.1	**START UP & COMMISSIONING SPARES**	
	Start-up & Commissioning Spares shall be part of the main supply of the WBM. Start-up & commissioning spares are those spares which may be required during the start- up and commissioning of the equipment/system. All spares required for successful operation till commissioning of WBM shall come under this category. Bidder shall provide an adequate stock of such start up and commissioning spares to be brought by him to the site for the equipment erection and commissioning. The spares must be available at site before the equipment's are energized.	
14.2	**MANDATORY SPARES**	
	a) The list of mandatory spares considered essential by the Employer is indicated in the list below. The bidder shall indicate the prices for each and every item (except for items not applicable to the bidders design) in the 'Schedule of Mandatory Spares' whether or not he considers it necessary for the Employer to have such spares. If the bidder fails to comply with the above or fails to quote the price of any spare item, the cost of such spares shall be deemed to be included in the contract price. The bidder shall furnish the population per unit of each item in their Bid. Whenever the quantity is Mentioned in "sets" the bidder has to give the item details and prices of each item. b) Whenever the quantity is indicated as a percentage, it shall mean percentage of total population of that item in the station (project), unless specified otherwise, and the fraction will be rounded off to the next higher whole number. Wherever the requirement has been specified as a 'set' (marked by **) it will include the total requirement of the item for a unit, module or the station as specified. Where it is specified as 'set' (marked by*) it would mean the requirement for the single equipment / system as the case may be. Also one set for the particular equipment. e.g. 'set' of bearings for a pump would include the total number of Bearings in a pump. Also the 'set' would include all components required to replace the item; for example, a set of bearings shall include all hardware normally required while replacing the bearings. c) The assembly / sub assembly which have different orientation (like left hand, right hand, top or bottom), different direction of rotation or mirror image positioning or any other regions which result in maintaining two different sets of spares to be used for subject assembly / sub-assembly shall be considered as different type of assembly/sub-assembly. d) The prices of mandatory spares indicated by the Bidder in the Bid Proposal sheets shall be used for bid evaluation purposes. e) All mandatory spares shall be delivered at site at least two months before scheduled date of initial operation of the first unit. Bidder to provide the split up price for mandatory spares during placement of order.	

14.2.1 Hydro Cyclone

Hydro-cyclone isolation valve : 10% of each type OR 1 no. whichever is higher
Hydro-cyclone : 10% of each type OR 1 no. whichever is higher
Hydro-cyclone rubber lining-
Feed chamber and overflow chamber : 10% of each type OR 1 no. whichever is higher
Vortex finder & Apex Inserts : 10% of each type OR 1 no. whichever is higher

14.2.2 Feeders

	Desc	Qty	Vendor to Confirm Here whether quoted or not
1	**Belt**	**2 sets***	
2	Belt drive motors	1 no	
3	Belt drive reducer	1 no	
4	Speed reducer assembly	1 set*	
5	Weighing instruments	1 set*	
6	Feeder weighing roll	1 no	
7	Gravimetric feeder gate actuator assembly	1 no	
8	Counter assembly of feeder complete	1 no	
9	Feeder head pulley assembly	1 no.	

14.2.3 **LIMESTONE MILLS**

S.No	Description	Qty	Vendor to Confirm (Here whether quoted or not)
1.	Mill wear parts (liners) & grinding element	1 set	
	Note: One set of Mill wear parts (Liners) above is defined as under: 1 Set = (Grinding elements needed for complete replacement of one mill) X (8000 x 1)/GWL, rounded off to nearest highest whole number. Where: GWL = Guaranteed wear life of Mill wear parts as offered by the bidder.		
2.	Auxiliary motor	1 no	
3.	Gear box internals (including bearing and seals)	2 sets*	
4.	Complete gear box	1 set*	
5.	Lube oil/Grease System for		
5.1	Pump assembly	1 no of each type	
5.2	Motor	1 no of each type	
5.3	Pressure regulator	1 no of each type	
5.4	Filters	2 nos of each type	
5.5	Pump & motor coupling	1 no of each type	
6.	Slurry valves	4 no of each type and size	
7.	Slurry line bends	4 no of each type and size	

14.2.4 AGITATOR

S.No	Description	Qty	Vendor to Confirm (Here whether quoted or not)
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	

14.2.5 Mill Circuit Pumps

S.No	Description	Qty	Vendor to Confirm (Here whether quoted or not)
1.	Impeller Assembly	4 nos. of each type and size	
2.	Casing Liners (where replaceable liners are provided)	1 set	
3.	Seals	4 sets of each type and size	
4.	Bearings	1 no. of each type	

		and size	
5.	Motor	1 no of each type and size	
6.	Gear Box	1 no of each type and size of pump	
7.	Motor-Pump Coupling	1 no. of each type	

14.3 RECOMMENDED SPARES:

In addition to the spare parts mentioned above, the bidder shall also provide a list of recommended spares for 3 years of normal operation of the plant and indicate the list and total prices. This list shall take into consideration the mandatory spares specified in this Sub-Section and should be independent of the list of the mandatory spares. The Employer reserves the right to buy any or all of the recommended spares. The recommended spares shall be delivered at project site at least two months before the scheduled date of initial operation of first unit. However, the spares shall not be dispatched before the dispatch of the main equipment. Prices of recommended spares will not be used for evaluation of the bids. The price of these spares will remain valid up to 6 months after placement of Notification of Award for the main equipment. However, the Bidder shall be liable to provide necessary justification for the quoted prices for these spares as desired by the Employer.

14.4 SPECIAL TOOLS & TACKLES:

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

15.0 PERFORMANCE GUARANTEE

All performance tests for WBM shall be carried out in accordance with any latest international codes/standards.

1) Bidder shall furnish Performance guarantee for the design, manufacture, material, safe and trouble-free operation of the WBM and its accessories
2) Capacity of the WBM to be guaranteed 20 TPH(with output fineness of 90% or higher passing through 325 mesh for the range of Limestone specified elsewhere)
3) The Bidder shall ensure a design of the equipment to achieve an average target availability of 98% for 120 days.
4) All the wear parts of the WBM shall be guaranteed for a minimum wear life of not less

	than 8000hrs. 5) Bidder to guarantee ball consumption per ton of limestone throughput. Bidder shall furnish the minimum ball diameter below which the balls shall be replaced. 6) Noise level≤90 dBA(for ball mill excluding motor) and ≤85 dBA (for other equipments) at 1m horizontal distance from equipment/enclosures and 1.5m above operating floor is to be guaranteed excluding motor. 7) Vibration levels measured on the non-rotating parts shall not exceed the zone limit "B" as defined in ISO 10816 at steady conditions and shall not exceed the zone limit "C" as defined in ISO 10816 at transient conditions. 8) Acceptance tests to be carried out as per the procedure defined by the bidder which shall be submitted for BHEL/ NTPC approval. 9) In the event that the performance test is unsuccessful, bidder shall take necessary remedial action at his cost and the performance test shall be repeated. 10) Product size : 30 wt% slurry 325 mesh 90% passing limestone	
16.0	**BID EVALUATION CRITERIA FOR POWER CONSUMPTION:**	
1.	**POWER GUARANTEE** Bidder to specify the guaranteed power consumption of complete limestone grinding system as well as individual equipment in their offer. The following equipment's shall be considered for Guaranteed Power consumption calculation (GPC). a. Gravimetric feeder – 1 No. b. Wet Ball mill - 1 No. c. Mill Circuit Pump- 1 No. d. Mill circuit Tank Agitator- 1 No. e. Wet ball mill lubrication (HP Lube Oil Pump & LP Lube Oil Pumps) – 1 set working pumps	
2.	**BID EVALUATION CRITERIA FOR POWER CONSUMPTION:** Lowest value of the power consumption quoted by any bidder shall be taken as the base value. In case, Guaranteed Shaft power offered by the bidder exceeds the base value specified above, his bid price will be loaded for excess power consumption as per the formula given below. Adjustment factor for excess power consumption in INR = (GPC-BV) X PL X 1 No. of Working WBM GPC- Guaranteed Shaft Power Consumption quoted by bidder in KW BV- Lowest value of the power consumption quoted by any bidder PL- Power Loading @ 1,39,360.0 INR/KW	

17.0	**LIQUIDATED DAMAGES FOR POWER CONSUMPTION**	
	If actual shaft Power Consumption during prove out (or) PG Test operating at the duty point exceeds the value guaranteed by the bidder, liquidated damages for shortfall in performance shall be deducted from contract price as per the formula given below Liquidated damage deductible in INR per WBM = (GPC-APC) X P X 1 No. of Working WBM Where • GPC- Guaranteed Shaft Power Consumption quoted by bidder in KW • APC- Actual Shaft Power Consumption in KW • P- Penalty @ 1,39,360.0 INR per KW	
18.0	**WARRANTY**	
1.	The Bidder warrants that the equipments/ items shall be free from defects in the design, engineering, materials and workmanship of the Plant and Equipment supplied and of the work executed. The Defect Liability Period shall be thirty six (36) months from the date of supply (or any part thereof) or twenty four (24) months from the date of commissioning(or any part thereof), whichever first occurs. If during the Defect Liability Period any defect should be found in the design, engineering, materials and workmanship of the Plant and Equipment supplied or of the work executed by the Bidder, the Bidder shall promptly, in consultation and agreement with BHEL regarding appropriate remedying of the defects, and at its cost, repair, replace or otherwise make good (as the Bidder shall, at its discretion, determine) such defect as well as any damage to the Facilities caused by such defect.	
2.	In case of failure of the equipment to meet the guarantee, NTPC/BHEL reserves the right to reject the equipment. However, NTPC/BHEL reserves the right to use the equipment until new equipment supplied by bidder meets the guaranteed requirement .	
19.0	**FIRST FILL OF CONSUMABLES:**	
1.	Bidder's scope shall also include supply and filling of all chemicals, reagents, resins, lubricants, grease, filters and consumable items for operation up to commissioning including top up requirements. All lubricants proposed for the plant operation shall be suitable for all operating and environmental conditions that will be met on site consistent with good maintenance procedures as instructed in the maintenance manuals.	
2.	Detailed specifications for the lubricating oil, grease, gases, servo fluids, control fluids, chemicals including items qualities and quantities required per month of the plant operation for the NTPC/BHEL's approval herein shall be furnished within 2 months f placement of Order. On completion of erection complete list of bearings/equipment giving their location and identification marks shall be furnished to BHEL along with lubrication requirements. All types of chemicals, consumables, lubricants and grease shall be readily obtainable locally and the number of different types shall be kept to a minimum. For each type and grade of lubricant recommended, bidder shall list at least three equivalent lubricants manufactured by alternative companies.	

20.0	**TRAINING**	
	Successful bidder shall provide comprehensive training for NTPC/BHEL Engineering, O&M, Erection & Commissioning staffs at site covering all aspects of the WBM system - Operation & Maintenance, Troubleshooting etc.	
21.0	**CONFLICT**	
	Bidder's equipment shall be designed for and shall meet the service, performance and minimum level of quality requirements specified. Bidder shall be solely responsible for advising NTPC in writing of any conflicts between the specifications and Bidder's design, including performance and levels of quality. Bidder agrees that its obligations, liabilities and warranties shall not be diminished or extinguished due to its meeting the requirements of the Specification.	
22.0	**DOCUMENTATION**	
A	**DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER**	
	The Bidder shall submit all documents, drawings, diagrams and all such information, which are necessary to fully understand the offer for techno – commercial evaluation. As a minimum requirement, the following information shall be furnished to fully describe the scope of work and services offered. Duly filled-in Technical Data sheets (Annexure II) and guarantee schedule furnished under Annexure-III. a. PID diagram b. Performance curve c. Terminal point details. d. General Arrangement drawings indicating dimensional data with civil loads and pocket details. e. Rotor GD^2 (kg-m2) f. Torque Vs Speed curve g. Calculation of Motor rating, Bearing capacity and selection of coupling h. Bill of material along with material and code i. Overall space and headroom requirement with details of handling during Erection, operation & maintenance of the equipment. j. Erection, Operation & Maintenance manual with lubrication schedule k. Procedure for shop / site performance tests l. Time schedule for delivery. m. Quality Assurance Plan. n. Make of all bought out items.	

	o. Deviation list p. Spares list. q. Hoist / Crane requirement. r. Reference list of similar projects executed. s. List of proposed makes and vendors t. Training program and schedule for BHEL/NTPC personnel u. Equipment maintenance schedules The above documents are required for proper evaluation purpose and vendors are requested to comply with above in all respect.	
B	**DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT**	
	The Successful bidder shall submit necessary data, documents and drawings for review, approval with requirements specified here under. However as minimum the following shall be submitted. a. Duly filled technical datasheet. b. Warranted performance curves. c. General arrangement drawings indicating dimension and civil loading details. d. Motor Data e. Recommended repair procedure etc. f. Operation and maintenance manuals g. Any unique installation instructions shall be noted on the submitted drawings or be provided as a separate document prior to the submission of the Operation and Maintenance Manual. h. Erection schedule and component list. i. Successful Bidder shall submit Calculation for HT Motor power requirement for sizing HT Motor within 2 weeks from the date of ordering. Drawings that are reviewed by the NTPC/ BHEL will be returned to bidder with a transmittal letter with any comments and / or questions marked on the drawings or noted in the letter. All comments and questions must be resolved before a resubmission of drawings / documents. If the design has not developed enough to resolve some of the comments or questions, bidder shall place a “hold” on those items or areas of design. NTPC/ BHEL reserves the right to return drawings unprocessed to bidder if there exists any evidence that bidder has not acknowledged all comments and questions. All necessary GA drawings, sections, sub-assembly drawings, specifications of main and sub components and necessary set of operation & maintenance manual as asked by NTPC must be furnished by bidder in soft and hard copy forms. For all documents softcopy format shall be searchable pdf, however in addition all drawings, diagrams like P&IDS shall be supplied in ACAD or other editable format and all lists in Excel format. Further break up of technical	

	documents will be discussed during finalization of the purchase contract. Unless agreed otherwise, ten (10) hard copies and five (05) sets of electronic copies of all documents are to be submitted in the English language. Electronic Copies shall be submitted in primary original data format (e.g. DOC, XLS, DWG) as well as in a printable non-proprietary document format (e.g. PDF). Especially P&IDs shall be submitted as DWG files and PDF files. Bidder to ensure submission of hard copies as per NTPC requirement for all engineering drg/doc and for all subsequent revisions along with a soft copy through email to concerned project team. However all the engineering related information shall be furnished in soft form to BHEL.	

23.0 ANNEXURES

ANNEXURE – I- QUALIFICATION REQUIREMENT

Bidder shall refer the document enclosed

ANNEXURE – II- TECHNICAL DATA SHEET

Sl. No	Description	Data
1.0	**GENERAL**	
	a. Client	BHEL- Ranipet
	b. Project	MOUDA
	c. Ultimate Customer	NTPC
	d. Location	Nagpur district ,Maharastra , India
	e. Service	Continuous
	f. Installation	inside the Building
	g. Qty —common for both units	1 Working + 1 Standby
2.0	**MANUFACTURER DETAILS**	
	a. Model	
	b. Type	Horizontal
	c. Type of Driver	Motor
3.0	OPERATING CONDITION	
	Medium to be handled	Limestone(size Diameter ≤25mm)
4.0	**PERFORMANCE DATA**	
	a. Capacity TPH	20
	b. WBM Dimensions WmXLmM	
	c. Effective volume m^3	
	d. BKW Normal /Maximum KW	
	e. Motor rating KW	
	f. Motor Speed RPM	
	g. Ball Mill Speed RPM	
	h. Noise level dB(A)	(less than __dB when measured at a distance of 1 meter)
	i. Performance curve	To be enclosed by bidder
4.0	**CONSTRUCTION DATA**	

Sl. No	Description	Data
	a. Manufacturer	
	b. Model No.	
	c. Journal bearing: Type / Size: (GA drawing to be enclosed.)	
	d. Thrust bearing: Type / Size:	
	e. Bearing cooling requirement	
	f. Cooling water qty required for two WBM	
	g. Type of drive	
	h. Shaft seal	
	i. Size / Code	
	j. Type of coupling (GA to be furnished)	Gear coupling with elastic pin (gear box & pinion side)
	k. Service factor	
	l. Shaft size at coupling location	
	m. clutch system GA	
	n. Rotation (viewed from mill outlet)	Clock-wise
	o. Coupling type	
	p. Coupling make	
	q. Base plate details to be provided for a. Inching motor b. WBM c. Pinion bearing housing gear box & main motor.	
	r. Total weight of ball mill system	
	s. Maximum Erection weight tons (shell and corner)	
5.0	**MATERIALS OF CONSTRUCTION**	
a.	Thickness of shell construction	
b.	Liner material & hardness	
c.	Discharge cover	
d.	Feed unit material of construction	
	Feed part	
e.	Discharge unit	
f.	WBM Ring Gear guard cover	
g.	Air clutch	
h.	Pinion drive material of construction	
i.	Shaft Seal	
j	Base frame material of construction	

Sl. No	Description	Data
6.0	**Technical Data**	
7.1	Bunker/Silo shut off gates	
a.	Manufacturer	
b	Type	
c.	Material of the gates & frame	
d.	Motor rating (KW)	
7.0	**Down spout**	
a.	Manufacturer	
b.	inside diameter (mm)	
c.	Thickness in mm+ linear thickness in mm if applicable	
d.	Height (mm)	
e.	Material	
f.	Off set between feeder outlet and center line of limestone bunker, if any	
8.0	**Gravimetric feeder**	
	Manufacturer	
	Type	
	Feeder size (l x w x h)	
	Normal capacity (tones/h)	
	Maximum capacity (tones/h)	
	Method of output control	
	Speed pulser allowable VA burden	
	Feeder belt width (mm)	
	Auxiliary power consumption (KW)	
	Type of Drive	
9.0	**Limestone Feeders**	**NA**
a.	Manufacturer	
b.	Model Number	
c.	Method of measurement	
d.	Range of measurement (kg/hr).	
10.0	**Downspout from feeder outlet to Pulverize.**	
a.	Manufacturer	
b.	inside diameter (mm)	
c.	Thickness (mm)	
d.	Material	
e.	Height (mm)	

Sl. No	Description	Data
f.	Off set between feeder outlet. and center line of limestone ball mill inlet between, if any	
11.0	**Limestone Pulverizer's**	
A.	Design Data :	
	a. Manufacturer	
	b. Type and model	
	c. Total Number of mills	
	d. Mill maximum capacity (kg/hr)	
	e. Size of raw limestone at mill inlet (mm)	
	f. Bond Index of Limestone	13 kwh/sh. ton
	g. Fineness of pulverized coal through 325 mesh (%)	
	h. Pulverizer Speed (rpm)	
	i. Number of mills working	
	j. Mill loading of working mills (% of maximum capacity) when no of mills as per (I) are operating	
	k. Mill Power Consumption	
	l. Mill Main Motor Rating (KW)	
	m. Main Motor (Voltage/H2/rpm)	
	n. Overall dimensions of mill	
	o. Total weight excluding motor	
	p. Solid Concentration (w/w %) in mill	
	q. Method of Classification	
	r. Ball Consumption (kg per ton of limestone)	
	s. Minimum ball diameter below which ball shall be replaced	
B.	Constructional Features	

<table>
<tr><th>Sl. No</th><th>Description</th><th>Data</th></tr>
<tr><td></td><td>a. Material / Thickness of Mill Wear Liners
b. Shell thickness____
c. Liner thickness____
d. Guaranteed Wear Life of Wear Liners (8000hours) minimum
e. Estimated labor (in man hours) for replacement of wear liners)
f. Material / Diameter (mm) of Ball
g. Hardness of Ball mill __
h. Refilling Ball size diameter __

Details of quantity & weight

<table><tr><th>Material grade</th><th>Ball size</th><th>Qty no</th><th>Weight in kg</th></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td></tr></table></td><td>Vendor to specify</td></tr>
<tr><td>C</td><td>Type of drive transmission</td><td></td></tr>
<tr><td></td><td>i) Make / Model of Gearbox
ii) Speed Ratio</td><td></td></tr>
<tr><td>D</td><td>Type of coupling</td><td></td></tr>
<tr><td>E</td><td>Pulverizer lube oil system</td><td></td></tr>
<tr><td></td><td>a) No. of lube oil pumps per pulverizer
b) No. of lube oil pumps working
c) No. of oil coolers per pulverizer</td><td></td></tr>
<tr><td>F</td><td>Auxiliary Motor Rating (KW) inching</td><td></td></tr>
<tr><td>G</td><td>Mill speed with Auxiliary Motor (rpm)</td><td></td></tr>
<tr><td>H</td><td>Mill Separator Tank</td><td></td></tr>
<tr><td></td><td>i) Capacity (m3)
ii) Material/Thickness (mm)</td><td></td></tr>
</table>

Sl. No	Description	Data
	iii) Lining Material/Thickness (mm) iv) No. of Agitators	
I	Mill circuit Pump	
	I) Number of pump ii) Make/Model centrifugal iii) Impeller Type iv) Material/Thickness (mm) of Impeller and lining v) Casing Type vi) Material/Thickness (mm) of Casing/Lining duplex? vii) Rated Flow Head (m3/hr/ m) viii) Slurry Solid concentration (w/w %) Wear Life of Pump components ix) Power Consumption x) Motor Rating (KW) IE3	
J	Agitators	
	i) No./Make/Model ii) Type (Top entry) iii) Speed (rpm) iv) Drive Mechanism (b/w motor & impeller) v) Shaft Material carbon steel with rubber lining vi) Material / Thickness (mm) of Impeller / Lining vii) Power Consumption(shaft power) viii) Motor Rating (KW) IE3 ix) Motor Speed (rpm)	
H	**Reducer**	
a.	Gear box make model number, catalogue	
b.	Input output speed and rpm ___ Input output torque ___	
c.	bearing are SKF/ RAG only	
d.	Type of cooling requirement /Hours	
e.	Oil quantity requirement / replacement period	

ANNEXURE III- SCHEDULE OF GUARANTEES:

Sl. No	Description			Data
1.	Rated capacity of Wet Ball Mill (WBM)	TPH	:	20
2.	Guaranteed power consumption at rated capacity	kW	:	Bidder to Provide
3.	Noise level at a distance of 1.0 meter from the equipment at site and 1.5 m above operating floor	dB(A)	:	≤ 90 dbA(for ball mill) ≤ 85 dbA(for other equipments)
4.	Maximum vibration (peak to peak amplitude at site)	microns	:	Bidder to Provide
5.	Equipment Availability (%) Continuous for 120 days		:	Bidder to Provide
6.	Life of WBM wear parts	Hours	:	≥8000 hours operation
7.	Scheduled Maintenance (Minor Overhauls): Recommended intervals between maintenance outages	hours	:	>25000 hours operation.
8.	Scheduled Maintenance (Major Overhauls): Recommended intervals between maintenance outages shall be	hours	:	>75000 hours operation.
9.	Limestone output fineness at rated capacity		:	≥ 90% through 325mesh.
10.	Guaranteed ball consumption		:	Bidder to provide
11.	In the event PG test is unsuccessful, bidder shall take necessary remedial action at his cost & PG test shall be repeated		:	Bidder to Confirm

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ANNEXURE – IV- LIST OF DEVIATIONS/EXCEPTIONS TO THE ENQUIRY DOCUMENT

Sl No	Clause No	Page No	Description of Deviation

Note: Enlarge the table to incorporate items

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ANNEXURE -V

A) DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER:

Sl. No.	Description	No of copies With proposal	Vendor to comply
1.	Specification each pages signed and stamped by vendor.	1	
2.	Deviation list to be furnished in annexure-IV	1	
3.	scope of supply(as per BHEL scope)		
4.	**Annexure to qualification requirement Annexure-3K. details.**	1	
5.	**Reference plant details of similar or higher capacity mill size supplied.**		
6.	GA& Cross section drawing of ball mill	1	
7.	P & ID diagram of ball mill system	1	
8.	P&ID diagram of lubrication oil system		
9.	Data sheet		
10.	T-S curve /and performance curve	1	
11.	Operation logic of ball mill system	1	
12.	Ball mill Sizing Calculation & motor sizing calculation ball mill	1	
13.	Required Electric power for complete Ball mill system	1	
14.	Total weight maximum weight maximum weight of single component to be handled during maintenance (required for hoist sizing)	1	
15.	Shortest Manufacturing Time	1	
16.	Sub-Vendor items list & vendor Name	1	
17.	Quality Plan	1	
18.	List of mandatory & recommended spares with price list (To be submitted along with offer)	1	
19.	List of Start-up & Commissioning to be provided (vendor scope)	1	
20.	List of Special Tools to be provided (vendor scope)	1	
21.	List of test to be demonstrate/performed at vendor work & at site vendor specify clearly.	1	
22.	Total price of the system with break up price sheet for major & miner items to be provided in main offer.	1	
23.	Catalogue	1	

B) DOCUMENTS TO BE SUBMITTED AFTER CONTRACT:

Sl. No.	Description	No of copies After award of contract	Delivery Time
1.	Utility Consumption	1	2 weeks after contract
2.	Foundation Data including Anchor plan	1	2 weeks after contract
3.	Performance curve	2	2 weeks after contract
4.	Assembly drawings of each equipment	1	1 month after contract
5.	Cross section detail drawing	1	1 month after contract
6.	Data Sheet	1	2 weeks after contract
7.	**Annexure to qualification requirement- Annexure 3K.**	1	2 weeks after contract
8.	Lubricating oil list	1	2 months after contract
9.	Special tools list	1	2 months after contract
10.	Installation and assembly procedure	1	4 months after contract
11.	Inspection and Test Procedure	1	1 month after contract
12.	Inspection & Test record	1	In 2 weeks after test
13.	Inspection Certificate	1	In 2 weeks after test
14.	Sub vendors List	1	2 weeks after contract
15.	Manufacturing Schedule	1	2 weeks after contract
16.	Progress report	1	Every month
17.	Proforma Packing List	1	2 months prior to shipping
18.	Approximate weight of each skid	1	2 months after contract
19.	Required Electric power	2	2 weeks after contract
20.	WBM and Motor Sizing Calculation	1	2 weeks after contract
21.	Material Test Certificates	2	In 2 weeks after test
22.	Pre Commissioning Check List	2	4 months after contract
23.	Scope of Supply	2	2 weeks after contract
24.	Quality Plan	4	1 month after contract
25.	Operation and Maintenance Manual	• 10 hardcopies and 5 electronic copies in English • 1 hardcopy and 1 electronic copy	4 months after contract

Sl. No.	Description	No of copies After award of contract	Delivery Time
26.	Spare List (Mandatory, Recommended)	1	1 month after contract
27.	Start-up & Commissioning Spares	2	1 month after contract
28.	List of Special Tools	1	1 month after contract
29.	Delivery Schedule	1	2 weeks after contract
30.	Test Arrangement & Test procedure	2	1 month after contract
31.	T-S curve	2	2 weeks after contract
32.	P & I Diagram	2	2 weeks after contract
33.	Catalogue	2	2 weeks after contract

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ANNEXURE-VI

TECHNICAL SPECIFICATION FOR SEAWORTHY PACKING (applicable for supplies from outside India)

Refer to Specification No: PE-TS-888-100-A001 for detailed specification on Seaworthy packing.

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ANNEXURE-VII

INSPECTION & TESTING

Refer to all clauses for Inspection & testing requirements.(Sample QP enclosed. Supplier shall submit the MQP in NTPC Format herewith) for approval of NTPC. It has to be noted that attached QP is indicative only. Stage inspection and Quantum of check may vary during final approval by NTPC)

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ANNEXURE-VIII

GA DRAWING OF BALL MILL BUILDING

REFER TO THE DRAWING ENCLOSED.

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ANNEXURE-IX

P&ID OF LIMESTONE GRINDING SYSTEM

REFER TO THE **P&ID** ENCLOSED.

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ANNEXURE-X

MOTOR DATASHEET FORMAT

BIDDER TO SUBMIT ALL THE DATASHEET FOR MOTORS IN THE FORMAT ENCLOSED.

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ANNEXURE- XI MOTORS,CABLES, JUNCTION BOX,INSTRUMENTS SPECIFICATION

REFER TO THE SPECIFICATION ENCLOSED

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ANNEXURE- XII **PIPING AND VALVES SPECIFICATION**

REFER TO THE SPECIFICATION ENCLOSED

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