



TD 106-1 Rev No. 6	Form No.		BHARAT HEAVY ELECTRICALS LIMITED PULVERISERS, HPEP HYDERABAD		Product STD NO.	BA89099
			TECHNICAL SPECIFICATION FOR MILL CIRCUIT TANK AGITATOR FOR NTPC RAMAGUNDAM		Rev. No. 00	
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***TECHNICAL SPECIFICATION FOR
MILL CIRCUIT TANK AGITATORS.***

Refer Doc			PREPARED	CHECKED	APPROVED	Date of 1st Issue:
			UDAY REDDY	PVS	AMAN	09.04.2022

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1. PROJECT INFORMATION

NTPC RAMAGUNDAM (RSTPS) is a plant set up by NTPC. The station is located in the Peddapalli district of the Indian state of Telangana. about 60 kms from Karimnagar town and 100 kms from Warangal. Ramagundam Railway station is on the Delhi - Chennai main line. Ramagundam is well connected to Hyderabad by Rajiv Rahadari state highway. The aerial distance from Ramagundam to Hyderabad is 178 km while the road distance between Ramagundam to Hyderabad is 209 km and by train it is 224 Km. Nearest commercial airport is Rajiv Gandhi International Airport, Hyderabad at about 250 km

a)	Owner	NTPC RAMAGUNDAM (RSTPS)
b)	Buyer	BHEL, Hyderabad
c)	Process/Application	Flue Gas Desulphurization

A) SITE CONDITIONS

Barometric Pressure

	Barometric Pressure		
	Minimum	Reference	Maximum
Observational Record hPa			
Design Value Outdoor hPa		995.38	

Ambient Temperature

	Ambient Temperature		
	Minimum	Reference	Maximum
Observational Record Deg C			
Design Value Outdoor Deg C	27		45
Design Value Indoor Deg C			

Relative Humidity

	Humidity		
	Minimum	Reference	Maximum
Observational Record %			
Design Value Outdoor %		60	
Design Value Indoor %			

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

- a. Country: India
- b. State/Division: Telangana.
- c. District: Peddapalli



2. GENERAL DESCRIPTION OF MILL CIRCUIT TANK AGITATOR

Agitator is part of Mill circuit tank, The Mill Circuit tank is provided to hold and dilute the circulating slurry of the mill circuit for desired operation of the Ball mill for limestone grinding. The main purpose of agitator is to avoid settling of limestone slurry and to maintain the slurry concentration at pump feed.

To prevent mechanical blocking load start up after standstill of pumps, piping and agitators for slurries shall be applied with C-hose connection.

Mill circuit tank agitator shall be of top entry (vertical) type and will be designed for continuous operation. The design of the agitators will be of proven type. The blades of the agitators shall be of stainless steel Alloy 926 or better. The shaft will be of CS material rubber lined.

S. No.	Description	Requirement
1	Quantity	
	Quantity of Agitators per tank	1 set
	Number of Circuit tanks	02
2	Parameters	
	Tank Details	PLEASE REFER ANNEXURE - 3 FOR TANK DRAWING
	Media to be Handled	Limestone Slurry
	Limestone and process water Analysis	Refer Clause No. 6
	Type of Agitator	Vertical mounted type.
	Duty	Continuous
3.	Application	Inside Mill circuit tank. Tank placed outdoor.
	Power Supply	
	The following voltage levels shall apply:	
	415 V \pm 10%, 50Hz	Standard voltage for power supplies to small electric power consumers and motors below 200 KW lighting and domestic
Design Ambient Temperature-- 50 Deg C.		
Bidder shall design and supply the equipment suitable for satisfactory operation under above mentioned power supply condition.		



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4.

CONTROL & INSTRUMENTATION SYSTEM


BASIC DESIGN CRITERIA:

When more than one device uses the same measurement or control signal, the transmitter and other components/ module shall be fully equipped to provide all signal requirements. All the 4-20 mA output signals from transmitters/other control system shall be able to drive minimum 500 Ohms load resistance. The system shall be arranged so that the failure of any monitoring device or control components or spurious intermediate grounding in the signal path shall not open the signal loop nor cause the loss or malfunction of signal to other devices using the same signal.

ENVIRONMENTAL CONDITIONS:

Instruments, devices and equipment's for location in outdoors/indoor/air-conditioned areas shall be designed to suit the environmental conditions indicated below and shall be suitable for continuous operation in the operating environment of a coal fired utility station and also during periods of air conditioning failure without any loss of function, or departure from the specification requirements covered under this specification.

Ambient Temperature (outside cabinets)	Pressure	Relative humidity	Atmosphere	Required protection Class of panels/ cabinets/ desks to be provided by contractor.
Outdoor Location				
55 degree C max.	Atmosp here	100 % Max.	Air (dirty)	IP 55
4 degree C min.	Atmosp here	5 % min.	Air (dirty)	IP 55

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3. APPLICABLE CODES & REGULATIONS


The design and materials shall conform to the requirements of applicable codes and regulations of the latest edition (as applicable as on date of bid opening). The design, manufacturing, installation and testing of the agitator shall follow the latest applicable Indian/International (ISO/ASTM/AISI/ASME/EN/Japanese) Standards. If any other country standard used shall also be accepted subjected to approval by NTPC, in such case bidder shall furnish adequate information to justify that these standards are equivalent or superior to the international standard mentioned above. A copy of such standard duly translated (complete word to word translation) in English shall be furnished by vendor.

4. INTENT OF SPECIFICATION

- 4.1. The specification covers Supply part, Services part and Mandatory spares comprising of design (i.e. Preparation and submission of drawing /documents including “As Built” drawings and O&M manuals), engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles, fill of lubricants & consumables till handing over, mandatory spares along with spares for erection, start-up and commissioning, forwarding, proper packing, shipment and delivery at site, assembly and services part covers supervision services for erection & commissioning, trial run at site and carrying out Performance guarantee tests at site, training of customer/ client O&M staff covering all aspects of the Agitator including Operation & Maintenance, Troubleshooting etc., training of customer at manufacturer's works (3 persons for 2 days including lodging and boarding) & handover in flawless condition of the package to the customer complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification, amendment & agreements till placement of order.


The following points may be noted.

- a) Agitator is part of mill circuit tank, details of which are given in Technical Information of Agitator.
- 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 /Pre-qualification requirement of NTPC. Necessary document evidences as per Attachment-3K for qualification shall be submitted along with the bid. If bidder doesn't meet the specified provenness criteria, their offer will be rejected.

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- 4.2. The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve them of the responsibility of providing such facilities to complete the supply, erection and commissioning, performance and guarantee/demonstration testing of Agitators for FGD Slurry Tanks.
- 4.3. It is not the intent to specify herein all the details of design and manufacture. However, the equipment / system shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgement is not in full accordance herewith.
- 4.4. The extent of supply under the contract includes all items mentioned in the specification and /or schedules. Similarly, the extent of supply also includes all items required for completion of the system for its safe, efficient, reliable and trouble free operation.
- 4.5. Items though not specifically mentioned but needed to make the system complete as stipulated under these specifications are also to be furnished unless otherwise specifically excluded.
- 4.6. The general terms and conditions, instructions to tenderer and other attachment referred to elsewhere are hereby made part of the tender specifications. The equipment / material and works covered by this specification is subject to compliance to all the attachments referred in the specification. The tenderer shall be responsible for adherence to all requirements stipulated herein.
- 4.7. While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Sec.-III of the specification within 10 days of receipt of tender documents. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser/Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of prebid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.

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- 4.8. Deviations, if any, should be very clearly brought out clause by clause along with cost of withdrawal in the enclosed schedule (in Section -II); otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification. If no cost of withdrawal is given against the deviation, it will be presumed that deviation can be withdrawn without any cost to BHEL/it's customer.
- 4.9. In the event of any conflict between the requirements of two clauses of this specification & requirements of different codes/standards and between respective clauses of sub-section C & sub-section D, more stringent clause as per the interpretation of the owner shall apply.
- 4.10. In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.
- 4.11. Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder/vendor and Customer/Purchaser/Employer will mean BHEL and/or Customer as interpreted by BHEL in the relevant context. Please refer GCC/SCC for better clarity.
- 4.12. The equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and dispatch release issued by BHEL/Customer.
- 4.13. BHEL's Customer's representative shall be given full access to the shop in which the equipment's are being manufactured or tested and all test records shall be made available to him.
- 4.14. Various codes and standards to be used shall be as indicated in various parts of the specification. In case bidder uses any standard other than those indicated in the specification, the onus of establishing equivalence of the same with the specified standards will rest with the bidder and acceptance of the same shall be sole prerogative of customer. The bidder will also arrange for BHEL a copy of the standards in ENGLISH language. The cost of such service will be deemed to have been included by the bidder in the total cost of the package. BHEL will not entertain any additional cost on account of the same.
- 4.15. All text/ numeric in the document / drawings to be generated by the successful bidder will be in English language only.
- 4.16. The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.

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5. PROVENNESS CRITERIA:

The Bidders are required to meet the Qualification Requirement (QR) for agitators as per enclosed **Annexure-1 & submit the Annexure to qualification requirement (Attachment-3K). Bidder's offers will be rejected if they fail to meet the QR.**

6. TANK DETAILS AND MEDIA ANALISYS

Tank details and analysis of limestone & water is as per enclosed Annexure-3.

7. SCOPE OF SUPPLY

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


Various inspections by the BHEL/NTPC shall not relieve the Bidder in any way of his obligation to maintain an adequate test, inspection, and documentation program of his own, and shall not relieve the Bidder of any other obligation under this specification. Furthermore, any inadvertent overlook of deviations from some requirements of this specification by the buyer shall not constitute a waiver of these requirements, or of the Bidder's obligation to correct the condition when it is discovered, or of any other obligation under this specification.

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

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

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

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

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TANK AGITATOR FOR NTPC RAMAGUNDAM**

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Supply: The scope includes the following:

- Includes manufacturing/fabrication, shop floor testing, stage inspections, final inspections, painting & packing.
- Mandatory spares as defined in section 15.2
- Recommended spare parts list to be furnished (is not part of scope of supply)
- Any special tools & tackles required for the entire equipment to disassemble, assemble or maintain the units.
- Start-up & Commissioning Spares
- First fill of consumables

Services: Services to be provided by the bidder:

- Detailed Erection and commissioning procedure shall be submitted by successful bidder for carrying out the erection and commissioning at site by BHEL.
- Supervision for Erection & Commissioning, trial run at site
- Performance guarantee tests at site & handover in flawless condition of the package to the customer
- Training of customer/ client O&M staff covering all aspects of the GDS- Operation & Maintenance, Trouble-shooting etc. at site
- Training of customer at manufacturers works (3 persons for 2 days including lodging and boarding)
- Visits shall be planned by BHEL site team and prior intimation shall be sent to supplier for visit to site for supervision services. Bidder shall be informed at least 10 days in advance for the requirement of visit at site. Visiting team shall consist of one or two expert of bidder as deemed necessary by them.
- Bidder shall prepare the model of all Agitators under scope in an integrated & intelligent 3D software solution using rule-based, data centric 3D Design software with equipment drawings, data sheets, BOQ, schematics and logic diagrams etc. in the aforesaid 3D model.
- After the completion of engineering the corresponding complete 3D review model shall be handed over to BHEL.

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

- a. AGITATOR Blades
- b. AGITATOR Shafts
- c. Coupling arrangement (Flexible)
- d. Gland Packing, Seals, O Rings, Glands
- e. Shaft Sleeve
- f. Lanterns/ Stools (Bearing Housing), Safety Guard



- g. Bearings
- h. Agitator Mounting Flanges with gaskets and fasteners
- i. Drive Motor(IE3) with gearbox arrangement
- j. Mating Flange for Supporting on Slurry Tank Roof
- k. Shims
- l. Painting and Rust Prevention during shipment and construction
- m. Packing and transportation
- n. Supervision of Erection & commissioning at site
- o. Special tools & tackles as applicable
- p. Start-up spares, Spare parts for commissioning & erection, Mandatory Spares: As per
- q. Project Specific Requirement
- r. Installation, operation and maintenance manuals
- s. Any other items required for completeness of the equipment except the items covered in the exclusions

8. GENERAL TECHNICAL REQUIREMENTS

Sl. No	Description	Vendor to confirm
1.	Agitator shall be designed for continuous operation.	
2.	The Material of Construction (MOC) of Agitator: Agitator blades shall be made with Alloy 926 or better material & Agitator shaft can be CS with rubber lined.	
3.	It should be roof mounted.	
4.	Agitators shall be vertical mounted type and shall be driven by motor with reducing speed gear box of rigid type, solid shaft coupling between gear box and agitator and flexible coupling of spacer type coupling between Motor and Gear Box. Both Gear Box and Motor should be vertically/horizontally flange mounted type with a common frame of the whole equipment. The entire thrust load of agitator should be transmitted to the thrust bearing of Gear box.	
5.	Nozzle size, on which Agitator shall be mounted, shall have enough opening to Insert rotating assembly from top. Bidder shall inform the required nozzle size. Further the mating flange shall be in the scope of the bidder.	
6.	Cable entry to the Motor terminal box should preferably be from top when motor is vertically mounted at its position and it should be easily accessible.	
7.	Impeller should be dynamically balanced to Gr: G16: ISO-1940 after rubber lining of shaft.	
8.	In case Bidder provides a Vertical Agitator with hub design the same has to be of Alloy 926 or better material	
9.	Operation speed of the Agitator motor shall be at least 25% below the first critical speed.	



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Sl. No	Description	Vendor to confirm
10.	Agitators shall be supplied in tanks and vessels to prevent caking and settlement of particles out of the slurry, e.g. in the limestone slurry tank, Auxiliary Absorbent tank, and sumps etc.	
11.	Standard type agitators with suitable characteristics shall be used wherever practical. The agitators shall be complete with motor, gearbox, agitator shaft, coupling, safety guards, impeller, support legs, agitator mounting flange including bolts nuts and gasket etc.	
12.	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.	
13.	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.	
14.	Lifting lugs and eyes and other special tackle shall be provided as necessary to permit easy handling of the agitators and their components.	
15.	Static and dynamic (as far as applicable) balancing of all agitators shall be carried out after assembly. Any deviation to this requirement is subject to customer approval during detailed engineering based on applicable codes and standards to be furnished by the bidders.	
16.	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.	
17.	All exposed moving parts shall be covered by guards.	
18.	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.	
19.	It shall be noted that all Agitators are meant for keeping the solid particles in suspended mode in liquid with "Full off-Bottom Suspension" of solid particles to 98% of liquid column to virtually "Uniform Solid Concentration". No chemical reaction will takes place.	
20.	Maintaining a uniform concentration over the 95% of liquid column. Absolute sweeping of solid particle from tank bottom is a must for all Agitators. If speed is required to be increased to guarantee the above requirements; the same can be increased by vendor. Bidder's machines that consume less power will be in an advantageous position.	
21.	It is to be noted that in continuous process any deposit at tank bottom is the loss of material which are not getting converted as per process. Hence, total loss of material by sedimentation is a loss to FGD Process & determines the "In efficiency of the Agitator".	
22.	Vendor should ensure nil settlement; utilization of solid material shall be a guaranteed parameter and will be assessed in percentage (%) term to net wet of solid mass of inflow or out flow. This is one of the guarantee parameter.	
23.	Agitator and its driver shall perform on the test stand at shop and on the Agitator's permanent location at site within vibration limit. The vibrations	



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Sl. No	Description	Vendor to confirm
	of combined unit will be the responsibility of Agitator manufacturer. Agitator manufacturer is to ensure that Site performance of vibration is one of the "Acceptance Criteria" of the equipment. Please note vibration at test stand can only be taken as for information.	
24.	Every Tank will have a pump whose suction line shall be connected to tank. These pumps are to operate continuously at the lowest operating level which is decided by Process requirement. Hence, the minimum operating level of liquid in every tank for every Agitator is a must to assess the combined operation of Agitator as well as that of pump alone. Any minor change in liquid level required by Agitator supplier will be accommodated only if it is acceptable to the pump supplier.	
25.	Agitator must have low-pitch propeller with low solidity ratio and Power Number. The Maximum Input Power at motor terminal shall be considered as a guaranteed parameter and the same shall be calculated for maximum liquid level in tank. A calculation of power specifying the hydraulic power of Agitator, Seal loss, Gear box and Motor internal loss must be submitted along with the offer. A characteristics curve showing power versus liquid level should be submitted from the lowest liquid level, required for Agitator to maximum liquid level in the tank. Motor should be selected based on the highest power demand with a 10% margin at maximum liquid level, taking into account frequency variation.	
26.	The agitator shall be suitably designed for mounting and operation in purchaser's tank whose drawings is annexed with the enquiry specification. The bidder shall review and comment on the BHEL's tank drawings for number and size of the baffles, sparger locations, mounting nozzle details etc	
27.	In case Bidder provides a Vertical Agitator with hub design the same has to be of Alloy 926 or better material. Impeller hub material has to be Alloy 926 or better material.	
28.	Unless otherwise specified, for small diameter impeller, it shall be possible to remove complete agitator assembly without dismantling through the opening provided on the tank/sump, and for large diameter impeller, the blade shall be of removable construction for ease of removal. Bidder shall also provide the headroom required for taking out the agitator as above.	
29.	Any instruments provided shall be Profibus Compatible.	
30.	Bidder shall provide the design and arrangement of baffle plates in circular tanks/rectangular sumps. Baffle plates are in BHEL scope.	
31.	Bidder shall provide proper dowelling between motor and base plate, gear box and mounting tool/base plate, for ease of assembly of agitator unit. Tapered dowell shall be provided.	
32.	Vendor shall provide suitable arrangement for supporting the agitator shaft with impellers during removal of gear-box for maintenance and details of such arrangements shall be furnished.	



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9. DESIGN AND CONSTRUCTION OF AGITATOR

(Bidder to fill and submit the enclosed technical data sheet along with offer)

9.1 BLADE AND HUB OF PROPELLER

Sl. No.	Description	Vendor to confirm
1.	The blades of the agitators shall be of Alloy 926 or better material.	
2.	The Blade design of the Agitator to be of most efficient design in order to offer least power consumption. The Agitator power consumption is part of the guarantee parameters.	
3.	Although Agitator will have substantial low speed because of reduction Gear Box, hydraulic unbalance at impeller can cause severe vibration, hence it is mandatory that rotating assembly shall be dynamically balanced to its rated speed. Any deviation to this requirement is subject to customer approval during detailed engineering based on applicable codes and standards to be furnished by the bidders.	
4.	Impeller should be dynamically balanced to Gr: G16: ISO-1940 after rubber lining of shaft.	

9.2 SEAL

Sl. No.	Description	Vendor to confirm
1.	Agitator shall be supplied with stuffing box or any proven equivalent or superior sealing type. Construction of Gland Packing shaft seal system shall be as per the below fig:	
2.	Agitator shall be supplied with stuffing box or any proven equivalent or superior sealing type. Mechanical and hydraulic conditions in the seal chamber, required to maintain a stable film at seal face, including temperature, pressure and flow, shall be jointly established by Agitator manufacturer and seal manufacturer, and shall be noted in data sheet submitted in tender. If mechanical seal is offered by bidder, the mechanical seal should be as per ISO-21049 / API 682.	



9.3 SHAFT

Sl. No.	Description	Vendor to confirm
1.	MOC of Shaft shall be CS with rubber lining (min 6 mm thk Chloro/bromo butyl rubber). Use of dissimilar material at flange joint shall be avoided to eliminate any crevice corrosion. Spacing of the shaft joint should not be more than 3.0 m for easy assembly if it is more than 40kg. If welding is used for joining two tubes, welding joint must be 100% radio graphed. If split shaft is proposed for larger tanks, shaft flange at the joining interface has to be rubber lined at manufacturer's works and necessary fasteners have to be provided.	

9.4 BEARING & BEARING HOUSING IN GEAR BOX

Sl. No.	Description	Vendor to confirm
1.	Bearing shall be of rolling type radial and thrust bearing (FAG/SKF/Timken make only) as required. Thrust bearing shall be sized for continuous operation under all specified condition.	
2.	Thrust bearing shall provide full load capability if the Agitator's normal direction of rotation is reversed. Up-thrust and Down-thrust load must be taken into account in sizing bearing. Life of the every anti-friction bearing, used in the bearing housing as per manufacturer's design, should have L10 of 25000 hr (minimum).	
3.	Bearing housing should be grease/oil lubricated. If bearing is oil lubricated, constant-level sight-feed oiler of 100cc size or bigger capacity is to be provided. Bearing housing should have oil drain, constant oil level indicator. A provision of one(1) number G1/2" thread (ISO-228, Part-1) port is required for remote control of temperature of bearing housing oil bath RTD.	
4.	If bearing housing requires cooling water, volume and pressure of cooling water is to be indicated in Technical Data Sheet.	
5.	Lubricating oil will be the responsibility of Gear Box manufacturer. Hence, manufacturer has to make arrangement of first fill of oil at installation and at commissioning stage. Quantity of oil and its grade is to be indicated in Drawing and Operation Manual.	

9.5 MATERIALS

Sl. No.	Description	Vendor to confirm
1.	Agitator components designated as "Full Compliance Material" shall meet the requirements of the industry specification as listed for the material in the table as well as in the specification in the respective section.	
2.	A detail quality plan is to be submitted along with offer for all items marked "Full Compliance Material".	



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| 3. | Final acceptance of the quality plan will be by ultimate user during detailed engineering without any commercial implication. QAP should be as per the best practice followed internationally to avoid any conflict of interest. | |
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9.6 GEAR BOX

Sl. No.	Description	Vendor to confirm
1.	Gear box should be vertical flange mounted solid shaft type (Vertical Agitators), reducing speed type, specially designed for the requirement of Slurry mixing and to be manufactured by the Agitator supplier. Complete up-thrust and down-thrust, developed by Agitator shall be taken by thrust bearing housing of Gear Box. An auxiliary slow drive provision shall be provided in the Gear Box so that slurry is always kept in dynamic condition to avoid settling of slurry at bottom, in the event of Agitator is not operating at its rated speed. Rating of Gear box shall be at least 1.5 times the rated torque of Agitator. Gear box details are subject to customer approval during detailed engineering without any commercial implications.	
2.	The reduction unit shall be procured from a reputed manufacturer and shall confirm to BS:721 (latest edition)/AGMA/Equivalent specification. The sub-vendor of the gear-box shall be approved by CUSTOMER during contract execution.	
3.	Gear drives shall have splash type oil lubrication. If oil pumps are used, they shall be removable for maintenance without disturbing the motor or drive housing.	
4.	The gear reduction unit shall always be provided with an oil drain, a breather and oil level gauge. The lubrication to be designed keeping in view that the temperature within the bearing should not exceed 85 Deg C.	
5.	The bidder shall provide an easily accessible oil level gauge and a dipstick that will indicate oil level under standstill and operating conditions.	

9.7 COUPLING & COUPLING GUARD

Sl. No.	Description	Vendor to confirm
1.	Coupling and coupling guard should be supplied between driver and driven equipment.	
2.	Coupling should be designed taking into consideration adequate service factor.	
3.	Design rating of the coupling (excluding service factor) should be indicated in data sheet	
4.	Coupling must be having locking screw so that it does not slide over shaft in due course operation.	



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| 5. | It is desirable that for servicing of seal, coupling half should not be removed. Coupling should be dynamically balanced to Gr: G6.3, ISO-1940. Any deviation to this requirement is subject to customer approval during detailed engineering based on applicable codes and standards to be furnished by the bidders. | |
| 6. | Removable coupling guard shall conform to the requirements of all applicable national, industrial or statutory regulations. | |

9.8 PLATE AND FASTENING BOLTS

Sl. No.	Description	Vendor to confirm
1.	Base plate shall be interpreted as the component of Agitator assembly through which the whole load will be transmitted to the Sole Plate/Nozzle over which the equipment will be mounted. The Base plate shall be fabricated with mild steel of structural quality (UTS=42N/sq mm minimum) with anti-corrosive paint of sufficient dry-film thickness.	
2.	Base plate must have provision of leveling on its intended mounting place. Nozzle is not in the scope of supply of Agitator manufacturer. It should be noted that Nozzle will be rubber lined to prevent any leakage of corrosive gases.	
3.	Alignment between Gear Head Shaft and Agitator shaft shall be within the permissible limit of Gear Box. Similarly, misalignment between Motor shaft and Gear Box Shaft shall be within 0.050 micron (radial) and 2 degree (angular) or better as per requirement of Motor and Gear Box	
4.	Base plate with desired number of hole shall be provided by the bidder, will be machined on one side. Base Plate shall be welded to the structure after leveling, as recommended by Agitator manufacturer and rubber lining is completed before placing the equipment in its desired location.	

9.9 OTHER COMPONENTS

Sl. No.	Description	Vendor to confirm
1.	All fasteners used in wetted condition must be of Alloy 926 or better material so that even if it comes in contact with liquid by swelling of rubber, thread remains unaffected. Raw material of fastener must undergo Inter-granular Corrosion test as per ISO-3651, Part-1 for Nitric Acid test.	
2.	Mounting flange dimensions shall be as per ASME B16.5 up to 600 NB, ASME B 16.47 for more than 600 NB.	
3.	Rubber Lining (As Applicable)	



- a) Rubber lined surfaces shall utilize 6 mm nominal thickness chlorobutyl rubber.
- b) Areas of high wear (e.g. leading edges on impeller blades) shall have an additional 6 mm of rubber for abrasion protection.
- c) No field-applied linings are permitted except for file patch kits.

9.10 MOTOR

Sl. No.	Description	Vendor to confirm
a)	<ul style="list-style-type: none"> ▪ Above 0.2 kW and upto 200 kW: 3 phase 415 V AC-VENDOR SCOPE <p>Bidder to submit the motor datasheets as per format given in the specification. Motor shall be sourced only from NTPC approved sources and data sheet approval shall be obtained from BHEL before placing order. If motor is procured from any new source, acceptance shall be subject to approval by NTPC/ BHEL before placing order and bidder shall submit relevant documents as per sub-supplier questionnaire attached in enclosed Annexure-5 (sub-supplier questionnaire). Double compression cable gland with lugs to be provided by the vendor, however, exact size will be informed to vendor after award of contract. Motors shall be as per the specification given in Annexure-4.</p>	
b)	Driver shall be sized to meet all specified operating conditions including bearing housing, seal, external gear box and coupling loss(if any).	
c)	Motor shall be able to accelerate to speed at reduced voltage and frequency as specified in "Site Power Supply Condition" as per Clause: 3.3.	
d)	<p>All AC motor shall be Squirrel cage induction motor and, shall be suitable for direct –online starting. Rating of the motor should of Type S1 (Continuously rated) as per ISO- 60034, Part-1. Rating of motor must be selected with minimum margin(as per the below table) above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variation:</p> <p>Agitator Rated BKW Motor Margin</p> <p><22KW 125% of Agitator Rated BKW</p> <p>22KW-55KW 115% of Agitator Rated BKW</p>	

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>55KW 110% of Agitator Rated BKW

9.11 FIELD MOUNTED LOCAL JUNCTION BOXES/LOCAL CABINETS & CONDUITS

Sl. No.	Description	Vendor to confirm
a)	Each equipment shall be furnished with required instrumentation and electrical accessory devices mounted and connected in a local cabinet or Junction box. Provisions shall be made for the interface between the local cabinet or junction box and the DCS such that the operation of the equipment's can be controlled from the BHEL supplied DCS in the FGD Control room.	
b)	<p>JUNCTION BOX shall be Powder coated Junction box with CRCA sheet for IP class IP65 and the following requirements to be met:</p> <p>No. of ways ----- 12/24/36/48/64/72/96/128 with 40% spares terminals.</p> <p>Material and Thickness----- 4mm thick Fiberglass Reinforced Polyester (FRP).</p> <p>Type--- Screwed at all four corners for door. Door gasket shall be of synthetic rubber.</p> <p>Mounting clamps and accessories----- Suitable for mounting on walls, columns, structures etc. The brackets, bolts, nuts, screws, glands required for erection shall be of SS, included in Bidders scope of supply</p> <p>Type of terminal blocks----- Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm². A M6 earthing stud shall be provided.</p> <p>Grounding----- To be provided.</p> <p>Color ----- RAL 7035.</p>	
c)	<p>CONDUITS</p> <p>Conduits shall be generally used for interconnecting cables from field instruments to Local JB's. All rigid conduits, couplings and elbows shall be hot dipped galvanised rigid mild steel in accordance with IS: 9537 Part-I (1980) and Part-II (1981). The conduit interior and exterior surfaces shall have continuous zinc coating with an overcoat of transparent enamel lacker or zinc chromate.</p> <p>Flexible conduits shall be water leak, fire and rust proof flexible GI conduits shall be provided. The temperature rating of flexible conduit shall be suitable for actual application.</p> <p>All rigid conduit fittings shall conform to the requirements of IS: 2667, 1976. Galvanized steel fitting shall be used with steel conduit. All flexible conduit</p>	



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	<p>fittings shall be liquid tight, galvanized steel. The end fittings shall be compatible with the flexible conduit supplied.</p> <p>Conduit sealing, explosion proof, dust proof and other types of special fittings shall be provided as required by these specifications and shall be consistent with the area and equipment with which they are installed. Fittings installed outdoors and in damp locations shall be sealed and gasketed. Hazardous area fittings and conduits sealing shall conform to NEC requirements for the area classification.</p> <p>Contractor shall provide double locknuts on all conduit terminations not provided with threaded hubs and couplings. Water tight conduit unions and rain tight conduit hubs shall be utilised for all the application which shall be exposed to weather. Moisture pockets shall be eliminated from conduits.</p> <p>Conduits shall be securely fastened to all boxes and cabinets.</p>	
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9.12 INSTRUMENTS

Sl. No.	Description	Vendor to confirm
a)	<p>Any instruments required for function of the system shall be provided by the vendor.</p> <p>Bidder has to follow the below mentioned philosophy for designing individual equipment P&ID's:</p> <ul style="list-style-type: none"> • Primary instruments like microprocessor based transmitters employing PROFIBUS protocol, thermocouples & RTD's along with temperature transmitters, pressure/diff pressure/temperature/flow*ultrasonic/electromagnetic) transmitter & gauges, flow sensing elements (orifice plates, flow nozzles etc.), ultrasonic, radar type level transmitters and density meter(coriolis type). • Integral to equipment which are not indicated in the tender drawings, but are required for control, monitoring and operation of the equipment for which no P&ID is attached shall be provided to meet the actual system requirements and meeting redundancy and other technical specifications. • For binary and analog inputs required in major equipment's of FGD system, protection triple-sensing devices shall be provided. Binary and analog inputs, which are required for protection of more than one equipment as well as protection signals for HT drives etc., triple sensing devices shall be provided. • For other critical binary and analog inputs required for protection and interlock purpose of other equipment (Eg. Those interlocks which may lead 	



to loss if production, non-availability of major equipment etc.,) **triple sensors** shall be provided

- Temperature elements, electronic transmitters etc., are to be provided for all the cases. Use of process actuated switches is acceptable only in case indicated in tender drawings.

All instruments shall be as per specification enclosed in **Annexure-4**.

9.13 NETWORKING PROTOCOLS AND CONTROL LOGICS:

Sl. No.	Description	Vendor to confirm
a)	All the measuring instruments, process instruments and electrical actuators shall be through field bus i.e. PROFIBUS protocol complying to IEC-61158.	
b)	Each equipment shall be furnished with required instrumentation and electrical accessory devices mounted and connected to local junction boxes. Bidder shall provide the control logic for the entire system.	

10. PACKING AND FORWARDING

S. No	Description	Vendor to confirm
a)	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 - 6 (Specification: HY0490569). 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.	
b)	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.	
c)	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	



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	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.	
d)	Crates and packing material used for shipping will become the property of owner (NTPC)	
e)	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.	
f)	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.	
g)	Each package should have the following inscriptions and signs stenciled with an indelible ink legibly and clearly: <ul style="list-style-type: none"> a. Destination b. Package Number c. Gross and Net Weight d. Dimensions e. Lifting places f. Handling marks and the following delivery marking 	
h)	<p>Each package or shipping units shall be clearly marked or stenciled on at least two sides as follows.</p> <p>NTPC RAMAGUNDAM (RSTPS) Peddapalli district, Telangana-India PINCODE:505215 EPC CONTRACTOR: "BHARAT HEAVY ELECTRICALS LIMITED, INDIA"</p> <p>In addition, each package or shipping unit shall have the symbol painted in red on at least two sides of the package, covering one fourth of the area of the side.</p>	
i)	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.	
j)	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.	
k)	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.	
l)	Wherever necessary besides usual inscriptions the cases shall bear special indication such as "Top", "Do not turn over", "Care", "Keep Dry"	


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	etc. as well as indication of the center of gravity (with red vertical lines) and places for attaching slings (with chain marks).	
m)	Marking for Safe handling: To ensure safe handling, packing case shall be marked to show the following: <ul style="list-style-type: none"> a. Upright position b. Sling position and center of Gravity position c. Storage category d. Fragile components (to be marked properly with a clear warning for handling) 	
n)	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.	
o)	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.	
p)	Prior to transport from manufacturer's work to destination, components unit shall be completely cleaned to remove any foreign particles. Flange and other machined surfaces shall be protected by an easily removable preventive coating followed by suitable wrapping.	
q)	All necessary painting, corrosion protection & preservation measures shall be taken as specified in painting schedule. Supplier shall consider the environment zone which is defined as "very severe" during finishing/shipping.	
r)	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.	
s)	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).	
t)	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.	



11. SUPERVISION OF ERECTION AND COMMISSIONING

Sl. No	Description	Vendor to confirm
a)	The erection of Agitator to be done by owner (BHEL) as per Erection Manual and check List provided by bidder. The bidder has to supervise for erection, pre-commissioning & post-commissioning check-up, start-up, trial runs of all the items covered under the scope of supply.	
b)	There will be two visits per agitator totally there will be 4 visits. The bidder will be informed well in advance for the visit. Bidder shall consider 5 working days per agitator.	
c)	In case erection and commissioning activities get delayed due to any account, resulting into overstay of vendor supervisory engineer beyond schedule time, then BHEL shall pay for additional man-day stay of vendor supervisory engineers. Vendor to quote Per day cost for deputation along with this offer.	
d)	TA/DA, boarding and lodging shall be borne by the bidder and shall be inclusive in supervision charges portion.	
e)	Charges for supervision of Erection & commissioning shall be quoted by the bidder.	
f)	Supervision charges for conductance of Performance guarantee test shall be borne by bidder. It is excluded from supervision of E&C charges.	
g)	Price comparison for evaluating the lowest bid will be considered all main supply, supervision of E&C charges and mandatory spares price all together.	


12. EXCLUSION

S. No	Description	Vendor to confirm
	The following work associated with the agitator will be by BHEL: a. Supply of mill circuit tank. b. Cable for motor (cable gland in bidder scope).	

13. QUALITY ASSURANCE

(As per approved quality plan. However, minimum requirements are as below)

S. No	Description	Vendor to confirm
1.	Quality Plan Requirement:	
	(i) MQP (Manufacturing Quality Plan) shall be submitted in attached format for BHEL/Customer review & approval. Typical MQP is attached for indicative purposes for guidance & use.	
	(ii) MQP shall invariably cover w.r.t Inward inspection including on Raw material Procurement, In process and Final inspection in elaborated way/details.	
	(iii) Bidder shall also to give specific confirmation that on need basis, their competent officials shall visit to BHEL/customer for finalization of Quality plan including test procedure/methodology during pre- award / post award approval / detailed engineering in the event of an order.	
	(iv) No deviation on BHEL/Customer approved MQP is acceptable.	
	(v) Bidder shall agree to submit all cross referred documents other than codes/standards to BHEL/Customer/Consultant.	
	Important Notes shall be included in MQP:	

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	<p>(a) Latest revision of Standard s & Specification shall apply. Only International Standards are applicable. Indian & Chinese Standards are not applicable</p> <p>(b) Materials shall be procured in compliance to Functional Technical Specification.</p> <p>(c) Inspection shall be in compliance with Approved Quality Control Procedure for the Product.</p> <p>(d) NDT shall be carried out by Qualified Personnel with compliance to Approved NDT Procedures and Acceptance Norms, as per ASME Section V.</p> <p>(e) Gauges and measuring Instruments, with valid calibration only shall be used.</p> <p>(f) Cleaning and Painting of products shall be carried out as per Approved Painting Schedule.</p> <p>(g) Finished Products shall be packed to comply with Approved Packing Schedule.</p> <p>(h) Welding shall be carried out by Qualified Personnel with compliance to Approved NDT Procedures and Acceptance Norms, as per ASME Section V.</p>	
2.	<p>Domestic / Inland Inspection will be carried out by BHEL/BHEL appointed Third Party Inspection Agency (TPIA) / Customer/Customer Appointed Inspection Agency/Consultant. This is applicable for all Stage inspection and Final Inspection identified as "W" - Witness or "CHP" - Customer Hold Point as per customer approved Quality Plan/ Technical specification / Approved Drawing/ Approved Data sheet / Scheme / PID / PFD / SLD (Process Instrumentation Diagram / Process Flow Diagram / Single Line Diagram) etc. (As applicable).</p> <p>“The inspection charges at actuals incurred by BHEL will be loaded to compare with foreign suppliers”.</p>	
3.	<p>Inspection Agency for Foreign Bidders and also for Indian Bidder but importing from Foreign Sources:</p> <p>(1) Any one of the following Third Party Inspection Agency (TPIA) shall be appointed by the bidder and same shall be furnished by the bidder in techno commercial bid itself.</p> <p>(2) The details of TPIA with contact details like Name of the official, Phone no, Email id shall also to be submitted during pre/post award. However cost for such inspection agency shall be borne by the bidder only. Inspection charges for such inspection agency shall be indicated separately so that if BHEL/Customer is undertaking the inspection by on their own, then these charges non claimable by the bidder.</p> <p>List of TPIA</p> <ol style="list-style-type: none"> 1) M/s Bureau Veritas 2) M/s TUV-Nord 3) M/s TUV-SUD 4) M/s TUV Rheinland 5) M/s Lloyds Register 6) M/s DNV 	

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4.	<p>Stage Inspection during manufacturing Process: Stage Inspection during manufacturing shall be carried out as per approved quality plan and all necessary documents shall be provided for review, verification and clearance for further processing. This inspection call shall be given well in advance (at least 2 weeks before) to TPI/Bidder's own inspection agency to avoid delay in the manufacturing processes.</p>	
5.	<p>Inspection before dispatch for domestic supplier: Inspection before dispatch at supplier's works shall be carried out by BHEL/BHEL appointed Inspection agency. Inspection shall be done as per approved Quality plan/ Technical specification/ Approved Drawing/ Approved Data sheet.</p>	
6.	<p>Inspection at Foreign Source/Supplier: (a) As in Sl. No.: 3. shall be ensured without fail. (b) No material / items shall be dispatched without getting the written communication from BHEL / Customer inspection carried out by BHEL/BHEL appointed Third Party Inspection Agency (TPIA) / Customer/Customer Appointed Inspection Agency/Consultant. This is applicable for all Stage inspection and Final Inspection identified as "W" - Witness or "CHP" - Customer Hold Point as per customer approved Quality Plan/ Technical specification / Approved Drawing/ Approved Data sheet / Scheme / PID / PFD / SLD (Process Instrumentation Diagram / Process Flow Diagram / Single Line Diagram) etc. (As applicable). Inspection before dispatch for Foreign supplier: Inspection before dispatch at supplier's works shall be carried out by bidder appointed inspection agencies having international presence at vendors and or vendor's sub vendor works. Inspection shall be done as per approved Quality plan/ Technical specification/ Approved Drawing/ Approved Data sheet by TPIA mentioned in Sl. no: 03 at supplier's cost.</p>	
7.	<p>Painting shall be done strictly as per BHEL/Customer approved painting schedule / scheme only. Paint Thickness / Paint shade shall be ensured as per BHEL / Customer approved painting schedule / specification / data sheet etc. No deviation is acceptable unless otherwise accepted by BHEL/Customer in writing. Any conflict if any among BHEL / Customer approved painting schedule / Spec / data sheet etc shall be brought to the notice to BHEL well in advance before proceeding including the BOI being procured for assy / skid like motors etc</p>	
8.	<p>Specific conformation for document package in the event of an order (2 Hard copies & soft copy in PDF file) is to be given containing the following with proper linkages (i) Index Sheet (ii) MQP/RQP/Endorsement Sheet (As applicable) (iii) TCs identified by BHEL/ Customer for record for "CHP" / "W" and Verification portion ("V") as given in approved QP. (iv) Final inspection report + TC including Chemical + Mechanical + HT + NDT etc. (v) Third party Inspection report + TC (vi) Customer CHP/ MDCC (vii) Type test / Performance Test reports conducted</p>	



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	(viii) Type test / Performance Test approval/ clearance obtained from BHEL/Customer (ix) BOM with As Build Drawings with actual make / rating used with BHEL/customer approved drawings.	
9.	Packing / Seaworthy Packing shall be as per BHEL Packing schedule / approved drg / sketch. This shall be ensured to take care transit / handling / transshipment in Road / Sea / Air. Photographs are to be submitted for BHEL review before dispatching the material as per contract conditions.	
10.	Outsourcing of test facilities: Bidder shall ensure all the testing facilities in house. However If any of the test facilities are not available with successful bidder, then bidder shall ensure the same at NABL accredited third party lab / Govt. / Govt. Lab for major testing such as NDT, Electrical & Mechanical testing.	
11.	Important Note: No deviation on the above requirement 01 to 10 is acceptable w.r.t Quality Requirement and those offers not meeting these specific customer requirement is liable for rejection and hence the bidder shall submit all the required documentary evidences in the offer itself.	
12.	## Necessarily to be filled up by the bidder at the time of offer itself otherwise the offer may not be considered w.r.t Quality Requirement being customer specific requirement.	
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.	



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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.	
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.	The Bidder shall furnish performance test procedure along with standard. The test procedure will be reviewed and approved by the BHEL/customer.	
3.	Since there is no standard for "Acceptance Test Procedure" for Agitator, Agitator manufacturer is to submit a test procedure and Quality Plan, clearly indicating that equipment will meet the desired parameter.	
4.	Power consumption at motor terminal and vibration of equipment will be conducted at site. Vendor to indicate other material tests that are to be conducted as per their practice in their Quality plan.	
5.	No liquid should enter the tube through any flange joint. "O"-ring used in the flange joint will deteriorate at a highly chlorinated and acidic environment of medium at a maximum operating temperature unless right quality of rubber is used. Hydrostatic testing of tube assembly is required at a pressure of twice that of maximum liquid column in any tank or 30m whichever is higher. The hydro test duration will be for a minimum of 1 hr to check sweating at any flange. Hydrostatic test is meant in part for a check of equipment joint at new condition only. It is cannot be considered as a guarantee of functional objective of rubber used.	
6.	Mechanical Run Test (in air): Each Agitator unit shall be given a 4-hour mechanical run test in air at vendor's shop. Agitator unit shall be mounted in the same manner as it will operate in the field. During this test the record shall be made of: a) Shaft run out at free end. b) Dynamic shaft deflection adjacent to the mechanical seal/packing/vapour seal. c) Gearbox oil temperature and temperature of bearing housing in stool. The temperature of the gear box oil shall not exceed ambient plus 40 Deg.C and that of bearing housing shall not exceed from room temperature plus 20 Deg.C after temperatures have stabilized. d) Bearing Housing vibration checks shall be carried out. Maximum acceptable vibration velocity shall be 6 mm/sec. e) Noise level shall be checked and shall be within the specified limits mentioned in the specification. f) Agitator shaft RPM and motor RPM. g) Check of satisfactory operation of shut off and retracting arrangement. Please also refer Sl. No. 8 below.	
7.	Mechanical Run Test (in slurry of similar concentration as applicable for the project)	



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	<p>Each agitator unit shall be given a load test in slurry at the vendor's shop. The duration of this test shall be 4 hours unless agreed otherwise between the Purchaser and the vendor.</p> <p>The following parameters shall be recorded during the test:</p> <ol style="list-style-type: none"> a) Dynamic shaft deflection adjacent to the mechanical seal/packing/vapor seal. b) Gear box bearing oil temperature and temperature of bearing housing in stool. The temperature of gear box oil shall not exceed ambient plus 40°C and that of bearing housing shall not exceed room temperature plus 20°C after the temperatures have stabilized. c) Bearing housing vibrations. Maximum acceptable vibration velocity is 6 mm/sec. d) Noise levels shall be checked and shall be within the specified limits mentioned in the specification. e) Electrical power input to the motor. f) Agitator shaft RPM and motor RPM. g) Check of satisfactory operation of shut off and retracting arrangement. <p>As a part of the Quality Assurance Plan, where possible as per facility available at bidder's work, bidder may demonstrate the power consumption also of each agitator at shop with the available fluid along with relevant calculation to establish the correlation with the slurry used for the project, apart from necessarily demonstrating power requirement at site.</p> <p>Please also refer Sl. No. 8 below.</p>	
<p>8.</p>	<p>In case of any constraints in carrying out shop tests indicated at Sl. No. 6 & 7 above, the Mechanical run tests for agitators shall be carried out with air/water at shop along with other test requirement in line with the QAP to be approved by customer (NTPC) during detail engineering.</p>	
<p>9.</p>	<p>Acceptance Test (at Site) After the agitator has been installed at site and is ready for test, vendor shall depute his representative to supervise the site acceptance test</p>	
<p>10.</p>	<p><u>DYNAMICS</u></p>	
<p>10.1</p>	<p><u>CRITICAL SPEED</u></p> <ul style="list-style-type: none"> • Operation speed of the Agitator motor shall be at least 25% below the first critical speed. • Additional to the requirement of the critical speed of Agitator, as specified above. Agitator manufacturer is to analyze the torsional critical speed of combined system of Agitator, Gear Box and Motor to establish there is a separation margin of minimum 20% between the torsional critical speed (dry/wet) and any operating speed. 	
<p>10.2</p>	<p><u>VIBRATION SEVERITY</u></p> <ul style="list-style-type: none"> • During performance test, unfiltered vibration measurements shall be made with running of Agitator in Air. Measurement shall be taken on the Gear Box thrust bearing housings as well in motor top. • Guaranteed Site vibration of the equipment on its own pedestal, at commissioning with normal level of liquid and with maximum liquid at respective tank, Vibration limit at site will be as per ISO-10816, and 1.5-2.3mm/sec even if Motor rating falls below 15kw. Any deviation to this 	



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	<p>requirement is subject to customer approval during detailed engineering based on applicable codes and standards to be furnished by the bidders.</p> <ul style="list-style-type: none"> • Vibration measurements of bearing housing shall be made in root mean square (RMS) velocity. • Vibration levels measured on the non-rotating parts shall not exceed the zone limit “B” as defined in ISO 10816 at steady conditions and shall not exceed the zone limit “C” as defined in ISO 10816 at transient conditions. 	
11.	For surfaces with rubber lining Welding shall be visually inspected to verify the absence of rough area and unacceptable transition between surfaces which prevent the adequate adherence of rubber. The acceptance criteria shall be as per latest standard.	
12.	For surfaces with rubber lining, degree of cleaning shall be visually checked before the application of the coating. There must be no area with oxidation, dirt or partially or generalized corrosion defects.	
13.	Test certificates shall be issued for each lot of raw material used in the coating, corresponding to specific weight and traction resistance.	
14.	For surfaces with rubber lining, adherence test shall be conducted on production samples. Adherence test shall be conducted on the actual surface through hammering. In order to verify the absence of air packets (or) surface without adherence.	
15.	For surfaces with rubber lining, Coating thickness shall be checked at 100%. A High voltage porosity test will be conducted on 100 % of the coated surface.	
16.	Out of all Agitators One Number of each type will be inspected at the Bidder's works before dispatch or where the test facilities are available.	
17.	The Bidder shall conduct performance test for the remaining Agitators and submit the reports.	
18.	Contract shaft mechanical seals shall be used during shop tests, unless the seal design is unsuitable for the shop-test condition, if applicable.	
19.	Agitators shall not be released for shipment, until shop tests data and performance tests curves have been approved by Owner.	
20.	Bidder should furnish performance guarantee as per applicable standard guarantee for the design, manufacture, material and safe operation of the equipment's.	
21.	Bidder to arrange all calibrated gauges, Instruments during inspection.	
22.	Mechanical running and the performance test shall be carried out. Bidder to arrange Motor of same / higher rating for the shop test and inspection.	
23.	All testing requirement/certificates shall be in line with QAP to be approved by customer during detailed engineering	
C)	PURCHASE AND SERVICE	
1.	The major items/ equipment's/ components to be manufactured in the shop of the contractor i.e. in-house items and those procured from sub-vendors / sub-manufacturer / sub-contractors i.e. bought out items (BOIs) shall be listed out by the contractor in their bid proposal.	
2.	The list of manufacturers/ sub-vendors for all the BOIs envisaged in contract shall be included in the bid proposal by the contractor which shall be reviewed by the NTPC during post bid discussions and the list of proposed manufacturers / sub-vendors for each of the BOIs shall be agreed/ approved. If any item is left out or gets included during detailed	



	engineering, the contractor shall propose the manufacturer's / sub vendor's details for review / approval of NTPC, prior to initiating the procurement of such materials.	
3.	This specification also contains the Indicative vendor list (with disclaimer) mentioned against particular item/ equipment/ component/ system etc. The vendor list are only indicative and not exhaustive. Refer Annexure-16	

14. PAINTING

The painting details shall be finalized during contract stage.

15. SPARES

15.1. START UP & COMMISSIONING SPARES

S. No	Description	Vendor to confirm
	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.	

15.2. MANDATORY SPARES (FOR EACH PROJECT)

Vendor to quote 1 Set per project. List of items with quantities per Set is as per below tables. Project Consists Of Two Sets of Agitator Assembly.

S. No	Description	Vendor to confirm
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.	



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	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. However, spares shall not be dispatched before dispatch of corresponding main equipment.	
f)	The Employer reserves right to buy any or all the mandatory spare parts.	
g)	Bidder to provide the split up price for mandatory spares during placement of order.	
h)	Bidder shall indicate the service expectancy period for the spare parts under normal operating conditions before replacement is necessary.	
i)	All spares supplied under this contract shall be strictly inter-changeable with the parts for which they are intended for replacements. The spares shall be treated and packed for long storage under the climatic	



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	conditions prevailing at the site e.g. small items shall be packed in sealed transparent plastic with desiccators packs as necessary.	
j)	All the spares shall be manufactured as per same specification quality plan.	
k)	The bidder shall provide employer with cross-sectional drawings, catalogues, assembly drawings and other relevant documents so as to enable the employer to identify and finalize order for recommended spares.	
l)	Each spare part shall be clearly marked or labelled on the outside of the packing with its description. When more than one spare part is packed in a single case, a general description of the content shall be shown on the outside of such case and detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification.	
m)	The bidder will provide the employer with all the addresses and particulars of his sub-suppliers while placing the order on vendors for items/components/equipment's covered under the contract and will further ensure with his vendors that the employer, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors.	
n)	The bidder shall guarantee long term availability of spares to the employer for the full life of the equipment covered under this contract. The bidder shall guarantee that before going out of production of spare parts of the equipment covered under the contract, he shall give the employer at least 2 years advance notice so that the latter may order his bulk requirement of spares, if he so desires. The same provision will be applicable to sub-contractors. Further, in case of discontinuance of manufacture of any spares by the bidder and/or his subcontractors, bidder will provide the employer, two years in advance, with full manufacturing drawings, material specification and technical information on alternate equivalent makes required by the employer for the purpose of manufacture/procurement of such items.	
o)	Wherever set is mentioned, one set of the spares of that item shall be for complete replacement of that particular item for one equipment.	



p)	Any fraction of an item shall mean the next higher integer.	
q)	Wherever quantity has been specified as percentage (%), the quantity of mandatory spares to be provided by bidder shall be the specified percentage (%) of the total population of the plant. In case quantity so calculated happens to be fraction, the same shall be rounded off to next higher whole number.	
r)	Where ever quantity has been indicated for each type, size, thickness, material, radius, range etc., the same shall be furnished in the bid.	
s)	In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed:	

15.2.1. AGITATORS

Sl. No	Description	Nos. /Sets for each project	Vendor to confirm whether quoted or not
1.	Impeller Assembly	1 EACH	
2.	Bearing Assembly	1 EACH	
3.	Motor	1 EACH	
4.	Gear Box Assembly	1 EACH	
5.	Agitators shaft assembly	1 EACH	
6.	Complete Agitator Assembly	1 EACH	

15.3. RECOMMENDED SPARES

S. No	Description	Vendor to confirm
1.	In Addition to the spare parts mentioned above, the contractor shall provide a list of recommended spares for 3 years of normal operation of the plant and indicate the list and total prices. The list shall take into consideration the mandatory spares into consideration. The employer reserves right to buy any or all the recommended mandatory spares, the recommended spares shall be delivered at project site at least two months before the schedule date of initial operation.	



- | | | |
|----|--|--|
| 2. | Prices of recommended spares will not be used for evaluation of the bids. The prices of these spares will remain valid up to 6 months after placement of Purchase order. However, bidder shall be liable to provide justification for the quoted prices for these spares as desired by employer. | |
|----|--|--|

16. SPECIAL TOOLS AND TACKLES

S. No	Description	Vendor to confirm
1.	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	

17. PERFORMANCE GUARANTEES AND SCHEDULE OF GUARANTEES

SCHEDULE OF GUARANTEES:

1. All performance tests for Agitators shall be carried out in accordance with latest international codes/standards.
2. Bidder shall furnish Performance guarantee for the design, manufacture, material, safe and trouble-free operation of the Agitators and its accessories
3. The Bidder shall ensure a design of the equipment to achieve an average target availability of 98% for 120 days and average target availability of 95% for 1 year.
4. Noise level ≤ 85 dB (A) at 1m horizontal distance from equipment/enclosures and 1.5m above operating floor is to be guaranteed.
5. 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.
6. Life of Agitator components/parts from the date of commissioning for continuous operation shall be guaranteed for 24 months.



7. Acceptance tests to be carried out as per the procedure defined by the bidder which shall be submitted for BHEL/ CUSTOMER approval.
8. 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.
9. For additional details of performance guarantee please refer 'functional guarantee'.

18.WARRANTY

S. No	Description	Vendor to confirm
1.	The Bidder warrants that the equipment/ 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.FIRST FILL OF CONSUMABLES:

S. No	Description	Vendor to confirm
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 after 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. TRAINING

S. No	Description	Vendor to confirm
	Successful bidder shall provide comprehensive training for NTPC/BHEL Engineering, O&M, Erection & Commissioning staffs at site covering all aspects of the LGS system - Operation & Maintenance, Troubleshooting etc. and also Engineering personnel at manufacturer's works.	

21. CONFLICT

S. No	Description	Vendor to confirm
	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. DOCUMENTATION

S. No	Description	Vendor to confirm
	Bidder shall submit necessary data, documents, GA drawings (PDF & DWG), 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 copy forms for review. The documents will be in PDF as well as editable form like DOC, XLS, DWG.	

A. TECHNICAL DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER:

Sl. No.	Description	Purpose
1.	Attachment-3K(annexure of Qualification Requirement refer Annexure-1)	Qualification Requirement (QR)
2.	Reference plant details of similar or higher capacity mill size supplied	QR
3.	Sign & Seal of bidder on all pages specification	Technical evaluation of Bid
4.	Deviation list (if any to be submitted by Bidder)	TEB



5.	GA drawing, Exploded view, sectional view with Material of construction, mechanical seal , gearbox for all Agitator models	TEB
6.	Data sheet for Agitator	TEB
7.	Utility Consumption	TEB
8.	Lubricating oil list	TEB
9.	Special tools list, Start-up & Commissioning Spares	TEB
10.	Terminal point details	TEB
11.	Catalogue	TEB

B. DOCUMENTS TO BE SUBMITTED AFTER CONTRACT:

Sl. No.	Description	Handing Over of Documents after PO in weeks	Document required for
1.	GA drawing, Exploded view, sectional view with Material of construction, mechanical seal , gearbox for all Agitator models	1	Customer Approval
2.	Data sheet for Agitator	1	Customer Approval
3.	Agitator Performance curve	1	Customer Approval
4.	Electrical motor GA drawing & Data sheet and performance curves of all motors	1	Customer Approval
5.	Quality plan & Inspection and Test Procedure	1	Customer Approval
6.	Agitator and Motor Sizing Calculation	1	Customer Approval
7.	O&M Manual for Agitator	1	Customer Approval
8.	Utility Consumption	1	Customer Approval
9.	Foundation Data including Anchor plan	1	Customer Approval
10.	Lubricating oil list	1	Customer Approval
11.	Special tools list, Start-up & Commissioning Spares	1	Customer Approval
12.	Installation and assembly procedure including Pre Commissioning Check List	1	Customer Approval
13.	Sub vendors List	1	Customer Approval
14.	Manufacturing Schedule	1	Review
15.	Special tools list	1	E&C
16.	Start-up & Commissioning Spares	1	E&C
17.	Pre Commissioning Check List	1	E&C
18.	Installation and assembly procedure.	1	E&C

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19.	Erection drawings and manual.	1	E&C
20.	Operation and Maintenance Manual with lubrication schedule.	1	E&C
21.	Recommended repair procedure.	1	E&C
22.	Electrical Load List with Single line Diagram.	1	For Feeder arrangement
23.	Control philosophy and Logic	1	For DCS program
24.	Catalogue	1	Customer Submission
25.	Pro-forma Packing List	1	Dispatch

ANNEXURES LIST:

Annexure Sl. No.	Description
1.	Qualification requirement.
2.	Deviation list.
3.	Circuit Tank Details and Media Analysis.
4.	Customer Specification.
5.	Indicative vendor list and Sub-questionnaire for suppliers.
6.	Packing & forwarding.
7.	Technical Data Sheet.

VARIANT TABLE

VAR. No.	DESCRIPTION	MATERIAL CODE	Qty /Project
Main			
00	Agitator Assembly	BA9789099002	2 Sets*
Mandatory spares- 1 Set #			
01	Impeller Assembly	BA9789099010	1 EACH
02	Bearing Assembly	BA9789099029	1 EACH
03	Motor	BA9789099037	1 EACH
04	Gear Box Assembly	BA9789099053	1 EACH
05	Agitators shaft assembly	BA9789099061	1 EACH
06	Complete Agitator Assembly	BA9789099002	1 EACH

* **Agitator assembly scope of supply per set is as per Chapter No.: 07.**

Mandatory Spares Set is as per Chapter No. 15.2

RECORD OF REVISIONS

Rev. No.	Date	Revision Details	Revised	Approved