



BHARAT HEAVY ELECTRICALS LIMITED
(A GOVT OF INDIA UNDERTAKING)

Flue Gas Desulphurization Group-FGD,
Ranipet

TECHNICAL SPECIFICATION OF AGITATORS

SPECIFICATION NO : NTPC:FGD:AGITATORS:R00
PROJECT OWNER : NTPC Limited, India
BUYER (EPC) : BHEL
APPLICATION : WET LIMESTONE FGD

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REV	Date	Description	Prepared	Checked	Approved

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I) DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER:

Sl. No.	Description	Offer part	Purpose
1.	Documents for meeting the Qualification Requirement as per Annexure-V for each project	Part -1	Qualification requirement for considering the offer
2.	Reference list – Annexure-VI	Part -1	Qualification requirement for considering the offer
3.	Compliance to the technical specification (Complete Specification with Signature and Seal along with annexures I,II,III)	Part-2	Technical evaluation
4.	Data sheet of all Agitators (As per Annexure-VIII) specific to the Project	Part-2	Technical evaluation
5.	GA drawing, Exploded view with Material of construction, total weight of all Agitator models offered specific to the Project	Part-2	Technical evaluation
6.	Performance curve & TS curve of Agitators specific to the Project	Part-2	Technical evaluation
7.	GA drawing of Electrical motor & Data sheet and performance curves of all motors (As per Annexure-IX) specific to the Project	Part-2	Technical evaluation
8.	Schedule of Guarantees (Annexure-X) specific to the Project	Part-2	Technical evaluation
9.	List of Deviations (Annexure-XI) specific to the Project	Part-2	Technical evaluation
10.	Mandatory Spare list (Annexure-XII) specific to the Project	Part-2	
11.	Agitator and Motor Sizing Calculation specific to the Project	Part-2	Technical evaluation
12.	Motor vendor list and mechanical seal vendor list	Part-2	Technical evaluation
13.	Quality Plan	Part-2	Technical evaluation
14.	Start-up & Commissioning Spares-	Part-2	Technical evaluation
15.	List of Special Tools	Part-2	Technical evaluation
16.	Catalogue	Part-2	Technical evaluation
17.	Priced offer specific to the Project	Part -3	Commercial evaluation



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II DOCUMENTS TO BE SUBMITTED AFTER CONTRACT:

Sl. No.	Description	Purpose	Delivery Time
1.	GA drawing, Exploded view, sectional view with Material of construction, mechanical seal , gearbox for all Agitator models	NTPC/BHEL approval to start manufacturing	2 week
2.	Data sheet for all Agitator	NTPC/BHEL approval to start manufacturing	2 week
3.	Agitator Performance curve of all Agitators	NTPC/BHEL approval to start manufacturing	2 week
4.	Electrical motor GA drawing & Data sheet and performance curves of all motors	NTPC/BHEL approval to start manufacturing	2 week
5.	Quality plan & Inspection and Test Procedure	NTPC/BHEL approval for inspection	2month after
6.	Agitator and Motor Sizing Calculation	NTPC/BHEL approval to start manufacturing	
7.	Utility Consumption	To arrange utility	2 week
8.	Foundation Data including Anchor plan	To civil design	2 week
9.	Lubricating oil list	Record purpose	4 week
10.	Special tools list	For maintenance	4 week
11.	Installation and assembly procedure	For erection	4 week
12.	Approximate weight of each skid	To arrange lifting device	4 week
13.	Pre Commissioning Check List	For erection	4 week
14.	Operation and Maintenance Manual	For O&M	4 week
15.	Start-up & Commissioning Spares	For commissioning	4 week
16.	List of Special Tools	For arranging	4 week
17.	P & I Diagram (if applicable)	For information	4 week



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1.0 APPLICABLE CODES & REGULATIONS

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

2.0 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 & performance testing at bidder's works/ site of Agitators along with accessories which is furnished in the Flue Gas Desulphurization plant for NTPC Project. The following points may be noted.

- a. Agitators are envisaged in various tanks, details of which are given in technical information "Annexure-VII-Technical Information of Agitators".
- 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-V-Provenness Criteria** . 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, 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 XI- LIST OF DEVIATIONS OR EXCEPTIONS TO THE ENQUIRY DOCUMENT**)
- 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.



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3.0 PROVENNESS CRITERIA/QUALIFICATION REQUIREMENT:

The Bidders are required to meet the Qualification Requirement (QR) for Agitators as per **Annexure-V-Provenness Criteria & shall submit the credentials as called in Attachment 3K. Bidder shall also submit Reference list as required in Annexure-VII. Bidder will be qualified only after approval from NTPC. Only OEMs shall be considered for placement order.**

4.0 TECHNICAL INFORMATION

DETAILS OF AGITATORS REQUIRED IN VARIOUS TANKS ARE GIVEN IN “Annexure-VII-Technical Information of Agitators”:

POWER SUPPLY DETAILS:

1.	POWER SUPPLY	
	The following voltage levels shall apply:	
	3 phase, 3.3 kV AC ,50 Hz	Voltage for motors equal to / bigger than 200KW and for power distribution within the plant.
	3 phase, 415 V, AC , 50 Hz	Standard voltage for power supplies to electric power consumers and motors Above 0.2 KW and upto 200 kW.
	240V AC / 3 phase 415 V AC, 50 Hz	Standard voltage for power supplies to electric power consumers and motors Upto 0.2 kW.
	1. All equipments shall be suitable for rated frequency of 50 Hz with a variation of + 3% & -5%, and 10 % combined variation of voltage and frequency unless specifically brought out in the specification. 2. Bidder shall design and supply the equipment suitable for satisfactory operation under above mentioned power supply condition.	

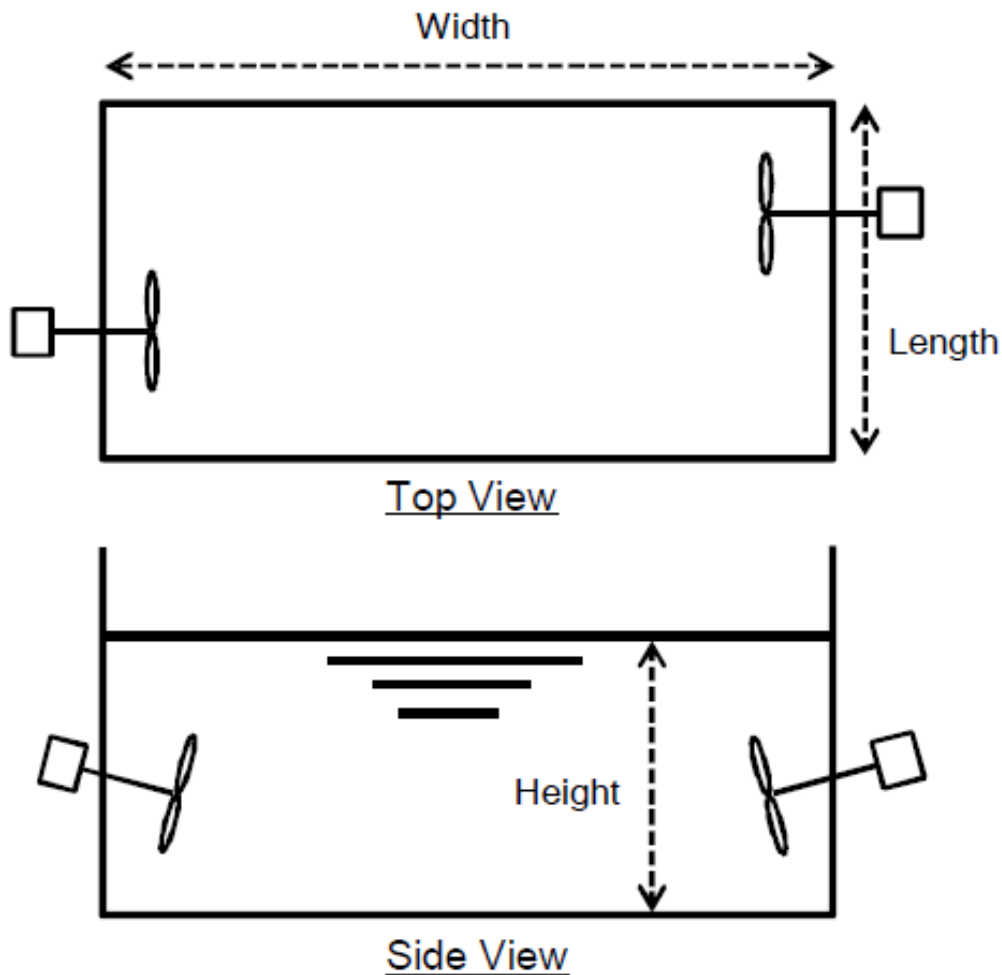
5.3 AGITATOR ARRANGEMENTS:

(1) Absorber Agitators (Rectangular Tank):

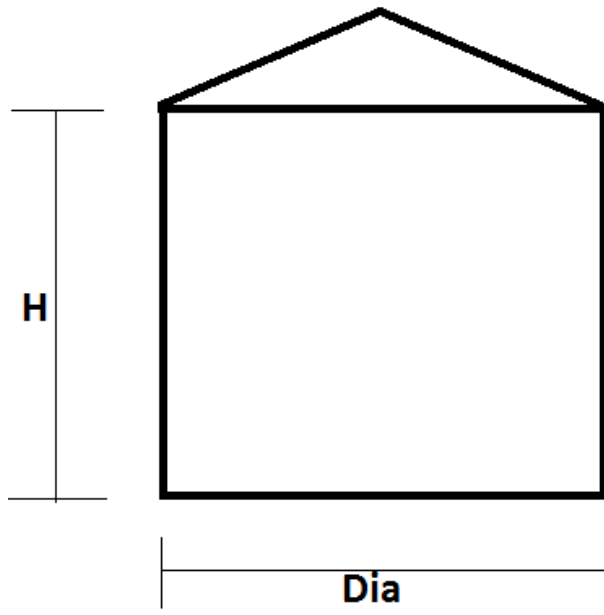
- a. The absorber agitators are Side Mounted / Horizontal type. The Dimensions of Each Absorber bottom tank shall be as per “Annexure-VII- Technical Information of Agitators”
- b. Length (L in Meters) X Width (W in Meters) X Height (H in Meters)

The arrangement of Agitators in Absorber as per Sketch-1 shown below.

SKETCH - 1

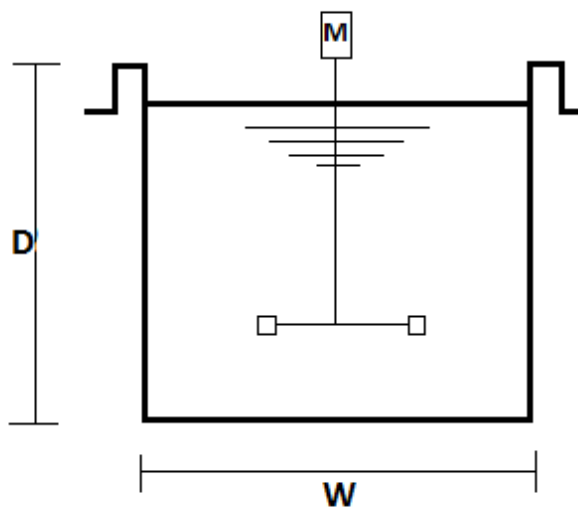


(2) Slurry Tanks including Auxiliary Absorbent Tank(Circular Tanks) :



These are circular tanks. The details are available in “Annexure-VII-Technical Information of Agitators”. Bidder to design the agitator considering the slope and the nozzle at the top of the tank.

(3) Drain Pit Tank Agitators:



These Agitators will operate continuously for FGD system operation. The Drain Pit Tank details are given in “Annexure-VII-Technical Information of Agitators”



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5.0 SCOPE OF SUPPLY

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

Design: Includes basic engineering, detail engineering, preparation and submission of engineering drawings/calculations/datasheets/quality assurance documents/field quality plans, storage instructions, commissioning procedures, 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, training of customer's O&M Personnel.

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

A) Agitators for Absorber and Auxiliary Absorbent Tanks (Horizontal Agitators):

Sl. No	Scope
1.	AGITATOR complete with
	i. AGITATOR Blades
	ii. AGITATOR Shafts
	iii. Coupling arrangement (Flexible)
	iv. Single Mechanical Seals
	v. Shaft Sleeve
	vi. Lanterns/ Stools (Bearing Housing), Safety Guard
	vii. Bearings
	viii. AGITATOR Mounting Flanges with gaskets and fasteners
	ix. Drive Motor(IE3) with gearbox arrangement
	x. Supporting arrangement of Side Entry Agitator on the tank Wall. Vessel Nozzle (SMO 254) and mating flange (SMO 254) for supporting on the tank wall
	xi. Flushing system for start up.
	xii. Foundation plate with foundation bolts, vessel nozzle
	xiii. Painting and Rust Prevention during shipment and construction
	xiv. Supervision of Erection & commissioning at site
	xv. Special tools & tackles as applicable
	xvi. Start-up spares as applicable
	xvii. Installation, operation and maintenance manuals
	xviii. Any other items required for completeness of the equipment except the items covered in the exclusions.



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B) AGITATORS FOR SLURRY TANK & DRAIN PIT TANK (VERTICAL AGITATORS):

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

5.1	TECHNICAL REQUIREMENTS
1.	Agitators shall be supplied in tanks and vessels to prevent caking and settlement of particles out of the slurry, e.g. in the absorber vessel, limestone mill recycle tanks, limestone slurry tank, Auxiliary Absorbent tank, and sumps etc.
2.	All agitators shall be designed for continuous operation unless otherwise specified. The design of the agitators shall be of proven type.
3.	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.
4.	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.
5.	The material for the shaft (which is continuously in contact with slurry) and agitator blades of the Absorber Agitators shall be made with Alloy 926 or better material. For Agitators in other tanks, agitator blades shall be made with Alloy 926 or better material and shaft can be rubber lined(minimum 6 mm thk Bromo/Chlorobutyl Rubber) . This does not release the bidder of the responsibility for selecting the correct materials.
6.	Each agitator and its associated equipment shall be arranged in such a manner as to permit easy access for operation, maintenance and agitator removal without interrupting plant operation. It shall be possible to remove the sealing devices of the Agitators of the absorber vessel without having to drain completely the absorber.



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7.	To prevent mechanical blocking load start-up after standstill of pumps, piping and agitators for slurries shall be applied with C-hose connection.
8.	Lifting lugs and eyes and other special tackle shall be provided as necessary to permit easy handling of the agitators and their components.
9.	Static and dynamic (as far as applicable) balancing of all agitators shall be carried out after assembly.
10.	All agitator parts and components shall be designed and calculated for fatigue life, considering maximum bending loads, induced by fluctuating hydraulic forces and torsional loads, based on the installed motor power. For side entry agitators the alternating bending moment resulting from impeller and shaft weight has to be considered additionally.
11.	All exposed moving parts shall be covered by guards.
12.	Side entry agitator shall be flange mounted.
13.	The shape of the impeller blades of side entry agitators shall be designed to avoid wear on the impellers which will affect the agitator performance as specified for a minimum period of 2 years of continuous operation under design conditions for the range of coal & limestone specified in the specification. In order to avoid excessive wear impeller tip speeds must not exceed 12 m/s
14.	Belt drives (if applied) shall be properly designed to provide a minimum lifetime of 2 years under design conditions
15.	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.
16.	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.
17.	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”.
18.	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.
19.	Agitator and its driver shall perform on the test stand at shop and on the Agitator's permanent location at site within vibration limit the vibration of combined unit will be the responsibility of Agitator manufacturer. Agitator manufacturer is to ensure that Site performance of vibration is one of the “Acceptance Criteria” of the equipment. Please note vibration at test stand can only be taken as for information.
20.	Every Tank will have a pump whose suction line shall be connected to tank. These pumps are to operate continuously at the lowest operating level which is decided by Process requirement. Hence, the minimum operating level of liquid in every tank for every Agitator is a must to assess the combined operation of Agitator as well as that of pump alone. The Tank water level is indicated as per “Annexure-VII-Technical Information of Agitators” (Technical Information)
21.	Agitator must have low-pitch propeller with low solidity ratio and Power Number of 0.3-0.35. The Maximum Input Power at motor terminal shall be considered as a guaranteed



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	parameter under “Schedule of Guaranteed Parameters” in “Annexure-X-Schedule of Guarantees” - 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.
22.	Any instruments provided shall be Profibus Compatible.
23.	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
5.2	CONSTRUCTIONAL FEATURES
A)	BLADE AND HUB OF PROPELLER
I)	The blades of the agitators shall be of Alloy 926 or better material.
II	The Blade design of the Agitator to be of most efficient design in order to offer least power consumption. The Agitator power consumption is part of the guarantee parameters.
III	Although Agitator will have substantial low speed because of reduction Gear Box, hydraulic unbalance at impeller can cause severe vibration, hence it is mandatory that rotating assembly shall be dynamically balanced to its rated speed.
IV	Impeller should be dynamically balanced to Gr: G16: ISO-1940 after rubber lining of shaft.
B)	SEAL
1.	<u>Horizontal / Side Entry Agitators for Absorber Tank and Auxiliary Absorbent Tank:</u>
I.	Agitators should be provided with Single Stage mechanical seal. the mechanical seal should be as per ISO-21049 / API 682
II.	The Mechanical Seals shall be so arranged that repacking or fitting of replacement seals can be carried out with the minimum of disruption to plant operation.
III.	Design the mechanical seals chamber to have sufficient room to lubricate and get seal face cool with its own slurry.
IV.	Provide requirements for periodical flushing to rinse the seal face for leaked slurry.
V.	All mechanical seals, regardless of type or arrangement, shall be of the cartridge design. Hook sleeve cartridge should not be used.
VI.	Requirement of flushing water, its quantity, and pressure to be indicated in data sheet.
VII.	Zero leakage is the intension of this specification. However, quantity of leakage, if it is unavoidable, it should have a provision of collecting / or discharging back to the tank.
VIII.	Mechanical seals shall be fitted and installed in the Agitator before shipment and shall be clean. Mechanical seals shall be plugged with screw for shipping.



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IX.	Intention of the specification is not to specify Type of Seal, Seal design, Spring configuration, Seal configuration, Balanced or Unbalance type etc. Agitator manufacturer to decide the same along with seal manufacturer the best seal that is suitable for the offered Agitator
X.	Seal life has to be guaranteed, taking into consideration all its components for 25000 hrs. If the seals fail before the completion of guaranteed period, the same should be replaced free of cost by the bidder.
XI.	The sub-vendor of the seal shall be approved by NTPC during contract execution.
2.	<u>Vertical Agitators for Other Slurry Tanks & Drain Pit Tanks</u>
I	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.
C)	SHAFT
	MOC of Shaft as per “Annexure-VII-Technical Information of Agitators” suitable to the service. 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.
D)	BEARING & BEARING HOUSING IN GEAR BOX
	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.
	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).
	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.
	If bearing housing requires cooling water, volume and pressure of cooling water is to be indicated in Technical Data Sheet.
	Lubricating oil will be the responsibility of Gear Box manufacturer. Hence, manufacturer has to make arrangement of first fill of oil at installation and at commissioning stage. Quantity of oil and its grade is to be indicated in Drawing and Operation Manual.
E)	MATERIALS
	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.



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	A detail quality plan is to be submitted along with offer for all items marked “Full Compliance Material”.
	Final acceptance of the quality plan will be approved by ultimate user (hereafter called NTPC). Hence, it is expected that manufacturer to submit quality plan (QAP) along with the offer. The same shall be followed at post order stage also. QAP should be as per the best practice followed internationally to avoid any conflict of interest.
F)	Driver (Motor)
1	Driver shall be sized to meet all specified operating conditions including bearing housing , seal, external gear box and coupling loss(if any).
2	Motor shall be able to accelerate to speed at reduced voltage and frequency as specified in “Site Power Supply Condition” as per Clause: 5.2.
3	It should meet Motor specification as per Annexure-I .
G)	GEAR BOX
	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 at Gear box shall be at least 1.5 times the rated torque of Agitator.
H)	COUPLING & COUPLING GUARD
I.	Coupling and coupling guard should be supplied between driver and driven equipment.
II.	Coupling should be designed taking into consideration adequate service factor.
III.	Design rating of the coupling (excluding service factor) should be indicated in data sheet.
IV.	Coupling must be having locking screw so that it does not slide over shaft in due course operation.
V.	Vertical Agitators - Coupling between Motor and Gear Box shall be Spacer-type flexible coupling, made of Cast Iron. Spacer length shall be of sufficient length so than Motor and Gear Box shall be able to run independently at no-load condition by detaching the respective coupling.
VI.	It is desirable that for servicing of seal, coupling half should not be removed. Coupling should be dynamically balanced to Gr: G6.3, ISO-1940.
VII.	Removable coupling guard shall conform to the requirements of all applicable national, industrial or statutory regulations.
I)	PLATE AND FASTENING BOLTS
I.	Base plate shall be interpreted as the component of Agitator assembly through which the whole load will be transmitted to the Sole Plate/Nozzle over which the



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	equipment will be mounted. The Base plate shall be fabricated with mild steel of structural quality (UTS=42N/sq mm minimum) with anti-corrosive paint of sufficient dry-film thickness.
II.	Base plate must have provision of leveling on its intended mounting place. Sole plate is not in the scope of supply of Agitator manufacturer. It should be noted that Sole plate will be rubber lined to prevent any leakage of corrosive gases
III.	Alignment between Gear Head Shaft and Agitator shaft shall be within the permissible limit of Gear Box. Similarly, misalignment between Motor shaft and Gear Box Shaft shall be within 0.050 micron (radial) and 2 degree (angular) or better as per requirement of Motor and Gear Box
IV.	Sole plate with desired number of hole, will be machined on one side. Sole Plate shall be welded to the structure after leveling, as recommended by Agitator manufacturer and rubber lining is completed before placing the equipment in its desired location.
J)	OTHER COMPONENTS
	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.
K)	ABSORBER AGITATORS and AUXILIARY ABSORBENT TANK:
I.	All Agitators shall be designed for continuous operation.
II.	The Absorber Agitators shall be of Horizontal / Side Entry type.
III.	The Material of Construction (MOC) of Agitators shall be Alloy 926 or better material as per "Annexure-VII-Technical Information of Agitators"
IV.	It should be of Flange mounted type.
V.	The shape of the impeller blades of side entry agitators shall be designed to avoid wear on the impellers which will affect the agitator performance as specified for a minimum period of 2 years of continuous operation under design condition.
VI.	Nozzle size, on which Agitator shall be mounted, shall have enough opening to Insert rotating assembly from side. Vendor to provide the nozzle and flange along with the agitator.
VII.	The Bidder to consider Gypsum Sedimentation during stoppage of Agitator.
VIII.	<u>The following information to be provided along with the bid:</u> a) <u>Impeller Diameter</u> b) <u>Impeller Speed</u> c) <u>Agitator Pumping Capacity (m³/min)</u> d) <u>Volume per Agitator:</u>



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L)	<u>SLURRY TANK & DRAIN PIT Tank AGITATORS:</u>
I.	All Agitators shall be designed for continuous operation.
II.	The Material of Construction (MOC) of Agitators: Agitator blades shall be made with <u>Alloy 926</u> or better material & Agitator shaft can be <u>rubber lined</u> as per “Annexure-VII-Technical Information of Agitators”
III.	It should be roof mounted.
IV.	Agitators shall be vertical mounted type and shall be driven by motor with reducing speed gear box of rigid type, solid shaft coupling between gear box and agitator and flexible coupling of spacer type 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.
V.	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.
VI.	Nozzle size, on which Agitator shall be mounted, shall have enough opening to Insert rotating assembly from top. Vendor to provide the nozzle along with the agitator.
VII.	In case Bidder provides a Vertical Agitator with hub design the same has to be of Alloy 926 or better material.
VIII.	Impeller should be dynamically balanced to Gr: G16: ISO-1940 after rubber lining of shaft.
IX.	Operation speed of the Agitator motor shall be at least 25% below the first critical speed.
X.	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 that the torsional critical speed is well off the operating speed by 20% from the operating speed.



5.3 MOTOR

➤ **Degree of Protection**

Degree of protection for various enclosures shall be as follows:

- a) Outdoor motors : IP 55
- b) Cable box-Outdoor area : IP 55

➤ **Codes and Standards**

- a) Three phase induction motors : IS325
- b) Single phase AC : IEC 60034

➤ **Painting**

Paint shade shall be as per RAL5012

6.3.1 AC Motors Type

AC Motors:

All AC motor shall be Squirrel cage induction motor and, shall be suitable for direct – on-line starting. Rating of the motor should of Type S1 (Continuously rated) as per ISO-60034, Part-1. Rating of motor must be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variation.

- a. All motors, the maximum temperature rise shall be 70⁰ C by resistance method for both class B & F insulation.
- b. For motors with starting time up to 20secs at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be 3 second more than the starting time at minimum rated voltage(85%). For motors with starting time more than 20secs and up to 45secs at minimum voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5secs more than starting time at minimum rated voltage(85%). For motors with starting time more than 45secs at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at high voltage limit shall be more than starting time at minimum rated voltage(85%) by at least 10% of the starting time. Speed switch mounted on the motor shall be provided in cases where above requirements are not met.
- c. Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque. Pull-out torque at rated voltage shall not be less than 205%of full load torque.



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- d. Starting voltage requirement will be 85% of rated voltage up to 1500kw rating motor.
- e. Single phase space heaters suitable for 240 v AC shall be provided on motors rated 30kw and above to maintain winding in dry condition when motor is standstill. Separate terminal box for space heater (As per clause no: 6.0.2) and RTDs shall be provided.
- f. All motors shall be Totally Enclosed Fan Cooled (TEFC), for Motors below 30 kw, winding shall be suitable for heating at 24v, 1 phase AC.
- g. Winding and Insulation shall be of type Non-hygroscopic, Oil and Flame resistant. It shall be capable two hot starts in succession with initially at normal running temperature. The insulation shall be Class B or better.
- h. Noise level of all motor shall be limited to 85 dB(A). Vibration shall be limited within the limit prescribed by IS12075, Part-14. Motor shall withstand the vibration produced by driven equipment. Combined vibration of the equipment at site shall only be accepted as per the Schedule of Guarantee Clause, as mentioned in the data sheet.
- i. Motor body shall have two earthing points on opposite side.
- j. inside the terminal box to suit the conductor size
 - Motors up to 1 kw - 8 SWG wire
 - 1kw - 30 kw - 25x3 mm GI flat
 - 30 kw - 60 kw - 25x6 mm GI flat
 - 60 kw & above - 30x 6 mm GI flat

5.3.2 Terminal Box

Motor MCR in KW	Minimum distance between centre of stud and gland plate in mm
UP to 3 KW	As per manufacturer's practice
Above 3 KW - upto 7 KW	85
Above 7 KW - upto 13 KW	115
Above 13 KW - upto 24 KW	167
Above 24 KW - upto 37 KW	196
Above 37 KW - upto 55 KW	249
Above 55 KW - upto 90 KW	277
Above 90 KW - upto 125 KW	331
Above 125 KW-upto 200 KW	203



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Terminal boxes of LT motors 160 KW (& above) shall be capable of withstanding system fault level of 31 MVA for 0.12 second.

Ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any tolerance)

▪ Upto 110KW	:	11.0
▪ Above 110KW & upto 1500KW	:	10.0
▪ Above 1500KW & upto 4000KW	:	9.0
▪ Above 4000KW	:	6 to 6.5

5.3.3 Testing of LT Motors

- a. LT Motors shall be of type tested quality. For each type and rating of LT Motors, rated above 50KW, the vendor shall submit for Owner's approval the report of all type tests as per relevant standards and carried out within last five (5) years from the date of Purchase Order(PO). These reports should be for the test conducted on the equipments similar to those proposed to be supplied under this contract, and the tests should have been either conducted at an independent laboratory or should have been witnessed by client.
- b. In case vendor is not able to submit the report of the type tests, conducted within last five (5) years from the date of PO or in case the type tests report are not found to be meeting the specification requirements, the vendor shall conduct all such tests under this contract free of cost to the ultimate purchaser (NTPC in this case) and submit the reports for approval.
- c. All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.
- d. All Motors shall be so designed that maximum inrush currents and locked rotors and pull-out torque developed at extreme voltage and frequency variation do not endanger the motor and driven equipments.
- e. Terminal boxes of breaker operated LT Motors above 160kw shall be capable of withstanding system fault level 31MVA for 0.12 second.
- f. The size and number of cables to be intimated to successful bidder during detail engineering and the contractor shall provide terminal box suitable for the same.



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6.0 GENERAL REQUIREMENTS:

S.No	Description
1.	Metric unit shall be used in the drawings and in the any displays on the equipment's. Special attention should be taken that the unit of pressure shall be in dual scales of kPa and kg/cm ² G. For instance the pressure gauges should have dual unit's indication.
2.	Descriptions in the drawings, in the documents, and in the displays shall be in English
3.	All rotating parts such as coupling shall be covered with suitable protective guards. Guards shall be easily removable type.
4.	The equipment shall be designed to withstand the corrosive and moist environment in which these are proposed to operate.
5.	Noise level produced by any rotating equipment individually or collectively shall not exceed 85 dB measured at a distance of 1.0 meters from the source in any direction and 1.5m above operating floor.
6.	The overall vibration level shall be as per ISO 10816.
7.	Suitable drain connections shall be provided.
8.	The equipment shall be suitable for stable operation continuously.
9.	Corrosion allowance: Corrosion allowance for entire equipment shall be in accordance with latest applicable Indian / International standard.
10.	Unless otherwise specified , flanges shall be in accordance with ANSI B16.5 Class 150
11.	Name plate: All equipment shall be provided with nameplates indicating the item number and service name. Name plates shall be of 304 Stainless steel plate and placed at a readily visible location. Nameplate of main equipment shall have enough information, which will be confirmed during engineering phase. Stainless steel nameplates for all instruments and valves shall be provided.
12.	Rotation arrows shall be cast in or attached with stainless steel plate on each item of rotation equipment at a readily visible location.
13.	Unless otherwise specified, all equipment items where the weight exceeds 15 kg shall be provided with suitable lifting lugs, ears or ring bolts or tapped holes for lifting rings. Minimum shock factor for lifting lugs shall be minimum 2.0. The position of lifting lugs and reference dimension shall be shown on GA and/or outline drawings. NDT shall be conducted for lifting lugs. When any spreader bars are required for lifting and laydown, the bidder shall provide spreader bar with equipment.
14.	Skid Mount/Transportation: Equipment shall be fabricated as skid mount design as much as practical to minimize erection at the site.
15.	If the driver/driven equipment train is in the resonance condition or any vibration problems occur, the bidder shall solve the problems in a timely manner.
16.	Bidder shall provide the necessary gaskets.



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S.No	Description
17.	All the surfaces of the carbon steel should be rust prevented before shipment for the period of at least 12 months for storage and construction.
18.	Bidder to provide capacity of crane or hoist required for material handling and the details of heaviest component to be handled.
19.	The list of all Bought out items with makes and country of origin to be mentioned along with offer to be submitted.
20.	Quality Plan to be submitted along with the offer.
21.	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.
22.	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.
23.	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 to take up with NTPC for approval.
24.	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.
25.	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 and BHEL. Bidder shall follow the procedures of inspection as per the approved QAP. Bidder has to submit the following documents along with inspection call and 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: b. Relevant Standards c. Specifications d. Approved drawings e. Data Sheets f. Calibration certificate for all the measuring instruments g. Bidder should also coordinate in getting the MDCC's (Material Dispatch clearance



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S.No	Description
	certificate) and all types of IC's (Inspection Certificates) from the NTPC along with BHEL.
26.	During detail engineering, bidder to strictly adhere to BHEL/NTPC drawing formats, document numbering, quality plan & FQP formats
27.	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.
28.	Complete detail engineering drawings, calculations, selection of components etc. shall be reviewed & subject to approval of BHEL/NTPC during detail engineering
29.	Bidder shall furnish necessary inputs & drawings of all equipment in editable Auto CAD/ MS-Word /Excel format.
30.	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.
31.	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 shall also be in the scope of the bidder.
32.	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"
7.0	PACKING AND FORWARDING
1.	Proper packing to be ensured. Indigenous Supply: Agitator & sub system assembly shall be wrapped in polythene bags & packed in a strong rigid wooden crate. Rain water should not enter into the Agitator internals during storage in the outer yard of power plant. Imported Supply: All imported supply should be packed as per Sea worthy packing standards Annexure - III. All imported items should have Sea worthy packing. Liberal packing materials and struts shall be provided to arrest rolling and to protect from transit damages.
2.	Equipment and process materials shall be packed and semi-knocked down, to the extent possible, to facilitate handling and storage and to protect bearings and other machine surfaces from oxidation. Each container, box, crate or bundle shall be reinforced with steel strapping in such a manner that breaking of one strap will not cause complete failure of packaging. The packing shall be of best standard to withstand rough handling and to provide suitable protection from tropical weather while in transit and while awaiting erection at the site.
3.	Equipment and materials in wooden cases or crates shall be properly cushioned to withstand the abuse of handling, transportation and storage. Packing shall include preservatives suitable to tropical conditions. All machine surfaces and bearings shall be coated with oxidation preventive



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S.No	Description
	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 per the dispatch instruction givens during the contract: In addition, each package or shipping unit shall have the symbol painted in red on at least two sides of the package, covering one fourth of the area of the side.
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



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S.No	Description
	following: - Upright position - Sling position and center of Gravity position - Storage category - 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 them to the appropriate shipping documents. All stencil marks on the outside of cases are either to be made in waterproof material or protected by shellac or varnish to prevent obliteration in transit.
15.	The packing slip shall contain the following information: - Customer name, Name of the equipment, Purchase Order number with Date, Address of the delivery site, Name and Address of the Sender, Serial Number of Agitator, 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.
8.0	SUPERVISION OF ERECTION, TESTING AND COMMISSIONING
1.	The erection of Agitators 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.



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S.No	Description
2.	No of visits required will be based on the No of Boilers. The bidder will be informed well in advance for the visit. Bidder shall include 15 working days for first visit & 5 working days for each of the Subsequent visit. Only supervision of Absorber Agitators are required in the Subsequent Visits.
3.	TA/DA, Site Expenses, Travel charges boarding and lodging shall be borne by the bidder and shall be inclusive in supply portion.
9.0	EXCLUSION
	The following work associated with the Agitators will be by others: a. Walkways, platforms and ladders b. Element handling hoists.
10.0	INSPECTION AND TESTING
	The 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 on the Agitators for review by BHEL/NTPC prior to manufacture.
2.	The Bidder shall furnish performance test procedure along with standard. The test procedure will be reviewed and approved by the BHEL/NTPC.
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.	DYNAMICS
7.1	CRITICAL SPEED
7.1.1	Operation speed of the Agitator motor shall be at least 25% below the first critical speed
7.1.2	Additional to the requirement of the critical speed of Agitator, as specified above. Agitator manufacturer is to analyze the torsional critical speed of combined system of Agitator, Gear Box and Motor to establish that the torsional critical speed is well off the operating speed by 20% from the operating speed.



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S.No	Description
7.2	VIBRATION SEVERITY
7.2.1	During performance test, unfiltered vibration measurements shall be made with running of Agitator in Air. Measurement shall be taken on the Gear Box thrust bearing housings as well in motor top.
7.2.2	Guaranteed Site vibration of the equipment on its own pedestal, at commissioning with normal level of liquid and with maximum liquid at respective tank, Vibration limit at site will be as per ISO-10816, 1.5-2.3mm/sec even if Motor rating falls below 15kw.
7.2.3	Vibration measurements of bearing housing shall be made in root mean square (RMS) velocity.
7.2.5	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.
8.	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.
9.	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.
10.	Test certificates shall be issued for each lot of raw material used in the coating, corresponding to specific weight and traction resistance.
11.	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.
12.	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.
13.	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.
14.	The Bidder shall conduct performance test for the remaining Agitators and submit the reports.
15.	Contract shaft mechanical seals shall be used during shop tests, unless the seal design is unsuitable for the shop-test condition, if applicable.
16.	Agitators shall not be released for shipment, until shop tests data and performance tests curves have been approved by Owner.
17.	Bidder should furnish performance guarantee as per applicable standard guarantee for the design, manufacture, material and safe operation of the equipments.



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S.No	Description
18.	BHEL shall witness the test at Bidder's works and a notice of minimum three (3) weeks shall be given for attending the inspection.
19.	Bidder to arrange all calibrated gauges, Instruments during inspection.
20.	Mechanical running and the performance test shall be carried out. Bidder to arrange Motor of same / higher rating for the shop test and inspection.
11.0	PAINTING
1.	Painting details for agitator support:- Surface Preparation : Blast Cleaning SA 2.5 PRIMER COAT: a. Primer: One coat of Two component moisture curing zinc (ethyl) silicate primer coat (Min 80% metallic zinc content in dry film, solid by volume minimum 60% ±2). Zinc dust composition and properties shall be as per Type II as per ASTM D520-00 DFT- 70μ Intermediate : One coat of Two component polyamide cured epoxy with MIO content (containing lamellar MIO Min 30% on pigment, solid by volume min. 80%±2) DFT- 100μ . FINISH COAT: Two coats of two pack aliphatic isocyanate cured acrylic polyurethane paint to IS 13213 solid by volume min.55%±2) DFT- 35μ/ coat With gloss retention (SSPC paint spec no.36, ASTM D4587, D2244, D523 of level 2 after min. 1000 hrs exposure, gloss less than 30 and colour change less than 2.0Δ E) COLOUR CODE Base: To be informed during contract stage Lettering: To be informed during contract stage
2.	Rust preventive paint after inspection at shop floor before dispatch shall be in bidder's scope
3.	Corrosion protection, coating and galvanizing, painting shall be taken care by the bidder. Bidder shall submit the painting scheme during detail Engg in line with the specification and shall be subject to approval of BHEL / NTPC.
12.0	SPARES,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.



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S.No	Description
12.1	START UP & COMMISSIONING SPARES
	Start-up & Commissioning Spares shall be part of the main supply of the Agitators. Start-up & commissioning spares are those spares which may be required during the start- up and commissioning of the equipment/system. All spares required for successful operation till commissioning of Agitator shall come under this category. Bidder shall provide an adequate stock of such start up and commissioning spares to be brought by him to the site for the equipment erection and commissioning. The spares must be available at site before the equipment's are energized. The List of such spares to be provided during bidding stage
12.2	RECOMMENDED SPARES
	Bidders shall also furnish the recommended spares list along with the offer required for 3 years of normal operation of the plant and should be independent of the list of the mandatory spares. Prices of recommended spares will not be used for evaluation of the bids. The price of these spares will remain valid up to 6 months after placement of Notification of Award for the main equipment.
12.3	MANDATORY SPARES:
	Bidder to quote for the mandatory spares mentioned in Annexure-XII- Mandatory Spare list. Bidder shall quote for the "Initial Spares Part List", and it will be considered for L1 evaluation. Initial spare parts items shall be handed over separately and shall not be mixed with the supply of the main equipment parts. Spares shall be sent in pre-decided lots in containers/secure boxes. All boxes/containers are to be distinctly marked in red color with boldly written "S" mark on each face of the containers. Spares shall not be dispatched before dispatch of corresponding main equipment's. Each item shall be labelled in English and be packed against damage and sealed to prevent deterioration from corrosion. The protection shall be sufficient for a minimum of 10 years' storage in a dry weatherproof building. All spares supplied under this contract shall be strictly inter-changeable with the parts for which they are intended for replacements. All the Initial spares shall be manufactures along with the main equipment components as a continuous operation as per same specification and quality plan. 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.
13.0	PERFORMANCE GUARANTEE
	All performance tests for Agitators shall be carried out in accordance with any latest international codes/standards. Bidder shall furnish Performance guarantee for the design, manufacture, material, safe and trouble-free operation of the Agitators and its accessories



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S.No	Description
	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. Noise level ≤ 85 dB (A) at 1m horizontal distance from equipment/enclosures and 1.5m above operating floor is to be guaranteed. 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. Acceptance tests to be carried out as per the procedure defined by the bidder which shall be submitted for BHEL/ NTPC approval. 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.
14.0	BID EVALUATION CRITERIA FOR POWER CONSUMPTION:
1.	POWER GUARANTEE Bidder to specify the total guaranteed power per Agitators operating at the rated capacity in their offer
2.	BID EVALUATION CRITERIA FOR POWER CONSUMPTION: The following Continuous Working agitators will be considered for power consumption: 1) Filtrate Water Tank Agitator 2) Secondary Hydrocyclone Feed Tank Agitator 3) Waste Water Tank Agitator 4) Limestone Slurry Storage Tank Agitator 5) Primary Hydrocyclone Feed Tank Agitator The best of the parameter for auxiliary power consumption quoted by any qualified bidder shall be taken as the base or ceiling value. Bid prices of other bidders will be loaded for every KW excess over the ceiling value as per the formula given below. Adjustment factor for excess power consumption = $(GPC-BV) \times PL \times \text{No's of Working Agitators}$ GPC- Guaranteed Power Consumption quoted by bidder in KW BV- base Value i.e. lowest quoted power consumption in KW PL- Power Loading per KW (bidder shall refer to Annexure-X "Schedule of Guarantees") Exchange rate as a bid opening date will be considered for evaluation



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S.No	Description
15.0	LIQUIDATED DAMAGES FOR POWER CONSUMPTION
	If actual 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 USD = (APC-GPC) X P X Total no of Working agitators Where GPC- Guaranteed Power Consumption quoted by bidder in KW APC- Actual Power Consumption in KW N- Total Number of Agitators P- Penalty per KW (bidder shall refer to Annexure-X "Schedule of Guarantees")
16.0	WARRANTY/DEFECT LIABILITY
1.	The Bidder warrants that the equipment's/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 Warranty Period shall be thirty six (36) months from the date of Supply or Twenty four (24) months from the date of commissioning, whichever first occurs. If during the Warranty/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 .
17.0	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 of placement of Order. On completion of erection complete list of bearings/equipment giving their location and identification marks shall be furnished to BHEL along with lubrication requirements. All types of 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.



TECHNICAL SPECIFICATION OF AGITATORS – NTPC PROJECTS

NTPC:FGD:AGITATORS:R00

S.No	Description
18.0	TRAINING
	Successful bidder shall provide comprehensive training for NTPC/BHEL Engineering, O&M, Erection & Commissioning staffs at site covering all aspects of the Agitators - Operation & Maintenance, Troubleshooting etc.
19.0	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.
20.0	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 Offer. 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 as specified in this specification. 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 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.

	BHARAT HEAVY ELECTRICALS LIMITED (A GOVT OF INDIA UNDERTAKING)	Flue Gas Desulphurization Group-FGD, Ranipet
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The Annexures VI to XII enclosed are specific to **NTPC Barh- II (2X660 MW)** and this shall be read along with the Main technical Specification Ref: **NTPC:FGD:AGITATORS:R00**



TECHNICAL SPECIFICATION OF AGITATORS -NTPC

Annexure-IV-Project Information for BARH-II (2X 660MW)

BARH-II Super Thermal Power Project (2X660 MW), a pit head coal based thermal power project, is located in Patna district of Bihar State. Basic inputs i.e. coal, water and land have already been tied up. The project is proposed for supplying electricity to the States & Union Territories of Northern, Western and Eastern Regions and the State of Jharkhand.

The capacity of the project is 1320 MW comprising of two (2) units of 660 MW each.

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

A) SITE CONDITIONS

Guarantee point

1.	Ambient Temperature and Relative Humidity		
a.	Average Site Condition ASC		
	Ambient Temperature	:	27 deg C
	Relative Humidity	:	60 %

Design point

2.	Ambient Temperature and Relative Humidity		
b.	Average Site Condition ASC		
	Ambient Temperature (Design)	:	45 deg C
	Relative Humidity	:	60 %

Note:

- 1) Guarantee Point 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 project site is located about 4 kilo meters from nearest town, BARH, in Patna district of Bihar.

a.	State/Division	Bihar
b.	District	Patna



TECHNICAL SPECIFICATION OF AGITATORS – NTPC PROJECTS

Annexure – V – Provenness Criteria/Qualification Requirement (SUB-QR) FOR BARH-II (2 X 660MW)

NTPC Clause No.

4.00.00 QUALIFYING REQUIREMENTS FOR Agitators

4.01.00 Only Manufacturers of Agitators can seek for qualification. In the event of Order, only Manufacturers will be considered for placement of order. The Bidder (Agitator Manufacturer) is required to meet the provenness criteria and/or qualification requirement for Agitator as stipulated below:

4.01.01 Agitators for the Wet Limestone based Flue Gas Desulphurisation (FGD) System offered shall be only from such manufacturer(s) who has previously designed (either by itself or under collaboration / licensing agreement), manufactured / got manufactured the respective equipment(s) of the type, application and minimum equipment rating as stipulated below such that the respective equipment(s) should have been in successful operation in at least one (1) plant for a period not less than one(1) year reckoned as on 18th March 2019

	Name of Equipment	Type of Equipment	Application	Equipment Rating
f)	Agitators	Vertical and Horizontal	Wet Limestone based FGD application in Coal fired power plant	Agitator rating not less than that supplied for 500 MW or higher size unit for similar application

Bidder shall offer and supply only the type of the above equipment(s) for which he himself is qualified.

4.01.03 A JV / Subsidiary Company formed for manufacturing and supply of equipment(s) as listed at clause no. 4.01.01 above in India, can also manufacture such equipment(s), provided that it has a valid collaboration or licensing agreement for design, engineering, manufacturing of such equipment(s) in India with a qualified equipment manufacturer who meets the requirements stipulated at clause 4.01.01 above (or the technology provider of the qualified equipment manufacturer) for the respective equipment(s). Before taking up the manufacturing of such equipment(s), the bidder must create /have created manufacturing facilities at his works as per collaborator's/licenser's design, manufacturing and quality control system for such equipment(s).

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



TECHNICAL SPECIFICATION OF AGITATORS – BARH I (3 X 660 MW)

NTPC:FGD:AGITATORS:R00

- 4.01.06 In case the Bidder is not manufacturer of proven Agitators as per clause 4.01.01 (f) above but is a manufacturer of Agitators for similar process/duty application in petrochemical or metals and mining industry, the Bidder or the proposed sub-vendor can also manufacture Agitators, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such Agitators in India with such manufacturer who meet the requirements stipulated at clause 4.01.01 (f) above for the Agitators. Before taking up the manufacturing of such equipment, the bidder/ his sub-vendor must create /have created manufacturing facilities at his works as per collaborator's /licenser's design, manufacturing and quality control system for such equipments.
- 4.01.08 Before taking up the manufacturing of such equipment(s) as per clause 4.01.02, 4.01.03, 4.01.04, 4.01.05(i), 4.01.06 & 4.01.07 above, the Bidder must create (or should have created) manufacturing and testing facilities at its works as per Collaborator / licenser's design, manufacturing and quality control system for such equipments duly certified by the Collaborator / licensor. Further, the Collaborator / Licensor shall provide (or should have provided) all design, design calculation, manufacturing drawings and must provide (or should have provided) technical and quality surveillance assistance and supervision during manufacturing, erection, testing, commissioning of equipments.
- 04.01.09 Bidder shall offer and supply only the type of the above equipment(s) for which it, itself or the manufacturer / Collaborator(s) / Licensor(s) proposed by the Bidder for the above equipment(s) is qualified.

Bidder shall submit the Attachment 3K enclosed along with Supporting Documents. Also, Bidder has to submit Reference list of Plants where Agitators have been supplied.

The following terminology shall be followed for Attachment 3K:

a) Bidder mean BHEL ;

b) Bidder's sub vendor means - Agitator Manufacturer

**FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE
FOR
LOT-1B PROJECTS
BIDDING DOCUMENT NO. CS-0011-109(1B)-9**

Bidder's Name and Address:

To
Contract Services-II
NTPC Limited
Noida-201301

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

Equipment Name	Sub-Vendor Name	Collaborator's Name, if applicable	Seeking Qualification as per clause..... Sub-Section-I, Part-A of Section-VI
Booster Fans			*4.01.01 /*4.01.02 /*4.01.03
*Slurry Recirculation Pumps			*4.01.01 /*4.01.03 /*4.01.07
Oxidation Blowers			*4.01.01 /*4.01.03 /*4.01.04
Wet limestone Grinding mills			*4.01.01 /*4.01.03 /*4.01.05 (i)/ 4.01.05 (ii)
Slurry Pumps			*4.01.01/*4.01.03
Agitators			*4.01.01 /*4.01.03 /*4.01.06
Vacuum Belt filters			*4.01.01 /*4.01.03

Note : *Strike-off whichever is not applicable.

1. If qualification sought as per clause 4.01.01, sub-section-I-A, Part-A of Section-VI then the details of the sub vendor (manufacturer) shall be filled by the bidder in the format A to G.

2. If the qualification sought as per the clause 4.01.02, sub-section-I-A, Part-A of Section-VI, then the details of proposed sub vendor (i.e manufacturer of such equipments for at least *195/*200/*500 MW unit rating) shall be filled individually by the bidder in the format A and the details of collaborator who meets the requirement stipulated at 4.01.01, sub-section-I-A, Part-A of Section-VI shall also be filled by the bidder in the format A separately. Further, in case of qualification vide clause 4.01.02, sub-section-I-A, Part-A of Section-VI a copy of valid ongoing collaboration and technology transfer agreement for design, engineering, manufacturing, supply of such equipment in India with the collaborator who meets the requirement stipulated at 4.01.01, sub-section-I-A, Part-A of Section-VI shall also be furnished.
3. If the qualification sought as per the clause 4.01.03, sub-section-I-A, Part-A of Section-VI then the details of JV/Subsidiary Company formed for manufacturing of such equipments in India shall be furnished individually for each equipment by the bidder such as,
 - i) Copy of document of incorporation of JV/Subsidiary company in India
 - ii) Copy of valid ongoing collaboration and technology transfer agreement for design, engineering, manufacturing, supply of such equipment in India with the collaborator who meets the requirement stipulated at 4.01.01, sub-section-I-A, Part-A of Section-VI.
 - iii) Copy of document of at least 26% equity participation of qualified equipment manufacturer in the Indian JV company/subsidiary company directly or indirectly through its holding company /Subsidiary company, which shall be maintained for a lock -in period of seven (7) years from the date of incorporation of such JV/subsidiary or up to the end of defect liability period of the contract which ever is later.

Further, the details of collaborator or technology provider of the qualified equipment manufacturer who meets the requirement stipulated at 4.01.01, sub-section-I-A, Part-A of Section-VI shall be filled by the Bidder in the format A to G (format given at 1.00.00). In addition to that, the sub vendor along with the Indian JV company/subsidiary company, qualified equipment manufacturer and its holding company/subsidiary company as applicable shall furnish the DJU.

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

- 1.00.00 (Applicable for Bidder/his sub vendors seeking qualification as per clause no. 4.01.01, Sub section-I, Part-A of Section-VI. Bidder shall furnish the required data only for those equipments / auxiliaries which are proposed to be sourced under this route.)

We, hereby furnish the data on proveness criteria for critical equipment, auxiliaries, systems and Bought Out Items such as Booster Fans, *Slurry Recirculation Pumps, Oxidation Blowers, Wet Limestone Grinding Mills, Slurry Pumps, & Agitators which have been designed (either by self manufacturer or under valid ongoing collaboration and technology transfer agreement), *manufactured/ *got manufactured and supplied by us /Manufacturer (or manufactured/ got manufactured & supplied by our proposed sub-vendors) and these are in successful operation in at least one (1) plant for a period not less than one year reckoned as on the date

of consideration for approval but not later than six months to award date of contract to the Main bidder. The details of type and minimum equipment rating of such equipment are given below :

- A. For Booster Fans:** We declare that, we/our Sub-Vendor, have designed (either by itself or under collaboration / licensing agreement),*manufactured/*got manufactured and supplied at least one (1) number of Booster Fan of minimum 80% of the flow & 100% of the head of the offered Booster Fan with Fan Speed 900 rpm (maximum), Axial type with variable pitch control working in a Coal fired power plant and which has been in successful operation for minimum one(1) year reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder, as per the details furnished below:

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

Sl. No.	Description	Reference Work
6.	Date of commission of the equipments:	
7.	Model no. of the equipment:	
8.	Brief Technical particulars of the equipments:	
9.	Flow -	m ³ /Sec with

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

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

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

* Strike off whichever is not applicable.



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

***2.00.00** **Applicable for Bidder/his sub vendors seeking provenness criteria as per clause no. 4.01.02, Sub section-I, Part-A of Section-VI.**

2.01.00 We, hereby confirm that we/our sub-vendors are a regular manufacturer of Booster Fan for units of atleast *195/*200/*500MW rating and the details in this regard on provenness criteria as per clause **4.01.01**, sub-section-I, Part-A, Section-VI are hereby furnished below:

***Bidder to strike off whichever is not applicable.**

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

2.02.00 We further confirm that details in respect of collaboration / valid licencing agreement for the aforesaid equipment as per 2.01.00 above who meets the requirement stipulated at clause **4.01.01**, sub-section-I, Part-A, Section-VI are enclosed at **Annexure-.....** to this Attachment. The data in respect of proveneness criteria for these equipment which are in successful operation in at least one (1) plant for a period not less than one reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder are furnished below. We further confirm that we/ our sub vendor(s) have created manufacturing and testing facilities at our/ their works as per collaborator's/ Licensor's design, manufacturing & quality control system for these equipment(s)/ Auxiliary(ies).

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

***3.00.00 Applicable for JV Company/Subsidiary Company meeting provenness criteria as per clause no. 4.01.01, Sub section-IA, Part-A of Section-VI.**

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

We further confirm that details in respect of collaboration / valid licencing agreement for the aforesaid equipment(s) (*Booster Fans, *Slurry Recirculation Pumps, *Oxidation Blowers, *Wet Limestone Grinding Mills, *Slurry Pumps, *Agitators) who meets the requirement stipulated at clause **4.01.01**, sub-section-I, Part-A, Section-VI for are enclosed at **Annexure-.....** to this Attachment.

***4.00.00** **Applicable for Bidder/his sub vendors seeking provenness criteria as per clause no. 4.01.04, Sub section-I, Part-A of Section-VI.**

4.01.00 We, hereby confirm that *we/*our sub-vendors is a manufacturer of Blowers/compressors for minimum 50 NM³/min capacity. (Details of references enclosed at Annexure)

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

4.02.00 We further confirm that details in respect of collaboration / valid licencing agreement for the Oxidation Blower between *us/*our sub-vendors, as per 4.01.00 above, and with qualified Oxidation Blower manufacturer, who meets the requirement stipulated at clause **4.01.01**, sub-section-I, Part-A, Section-VI are enclosed as per **Annexure-I** to this Attachment. The data in respect of proveneness criteria for the qualified Oxidation Blower manufacturer, which are in successful operation in at least one (1) plant for a period not less than one reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder are furnished below. We further confirm that we/ our sub vendor(s) have created manufacturing and testing facilities at our/ their works as per collaborator's/ Licensor's design, manufacturing & quality control system for the Oxidation Blowers.

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

We further confirm that details in respect of collaboration / valid licencing agreement for the Oxidation Blowers who meets the requirement stipulated at clause **4.01.01**, sub-section-I, Part-A, Section-VI for are enclosed at **Annexure-.....** to this Attachment.

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

***5.00.00** **Applicable for Bidder/his sub vendors seeking provenness criteria as per clause no. 4.01.05 (i), Sub section-I, Part-A of Section-VI.**

5.01.00 We, hereby confirm that *we/*our sub-vendors is a manufacturer of Dry Grinding Mills for minimum 20 T/h capacity. (Details of references enclosed at Annexure)

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

5.02.00 We further confirm that details in respect of collaboration / valid licencing agreement for the Wet Grinding Mills between *us/*our sub-vendors, as per 5.01.00 above, and with qualified Wet Grinding Mill manufacturer, who meets the requirement stipulated at clause **4.01.01**, sub-section-I, Part-A, Section-VI are enclosed at **Annexure-.....** to this Attachment. The data in respect of proveneness criteria for the qualified Wet Grinding Mill manufacturer, which is in successful operation in at least one (1) plant for a period not less than one reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder are furnished below.

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

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

In addition, the Bidder along with our sub-vendors, as per 5.01.00 above (if applicable) and the qualified Wet Grinding Mill manufacturer and its holding/ subsidiary Company, as applicable, shall furnish DJU in which executant of the DJU shall be jointly and severally liable for the successful performance of the equipment as per the format enclosed at **Annexure-III of Attachment-3K**.

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

***6.00.00 Applicable for Bidder/his sub vendors seeking provenness criteria as per clause no. 4.01.05 (ii), Sub section-I, Part-A of Section-VI.**

6.01.00 We, hereby confirm that *we/*our sub-vendors have designed, manufactured & supplied dry Grinding Ball Tube mills for at least 500 MW pulverized coal fired power plant. (Details of references enclosed at Annexure)

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

6.02.00 We further confirm that details in respect of valid licencing agreement for the Wet Grinding Mills between *us/*our sub-vendors, as per 6.01.00 above, and with qualified Wet Grinding Mill manufacturer, who meets the requirement stipulated at clause **4.01.01**,

sub-section-I, Part-A, Section-VI are enclosed at **Annexure-.....** to this Attachment. The data in respect of proveneness criteria for the qualified Wet Grinding Mill manufacturer, which is in successful operation in at least one (1) plant for a period not less than one reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder are furnished below.

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

We further confirm that *we/*our sub-vendors shall provide an extended warranty of three (3) years for the Wet Limestone Grinding Mills provide an additional on demand bank guarantee for INR 10 Million (Indian Rupees Ten Million only) for each project.

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

***7.00.00 Applicable for Bidder/his sub vendors seeking provenness criteria as per clause no. 4.01.06, Sub section-I, Part-A of Section-VI.**

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

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

7.02.00 We further confirm that details in respect of collaboration / valid licencing agreement for the Agitator between *us/*our sub-vendors, as per 6.01.00 above, and with qualified Agitator manufacturer, who meets the requirement stipulated at clause **4.01.01**, sub-section-I, Part-A, Section-VI are enclosed at **Annexure-.....** to this Attachment. The data in respect of proveneness criteria for the qualified Agitator manufacturer, which is in successful operation in at least one (1) plant for a period not less than one reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder are furnished below.

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

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

***8.00.00** **Applicable for Bidder/his sub vendors seeking provenness criteria as per clause no. 4.01.07, Sub section-I, Part-A of Section-VI.**

8.01.00 We, hereby confirm that *we/*our sub-vendors is a manufacturer of a manufacturer of Slurry Pumps who meets the requirements stipulated at clause 4.01.01 (e), sub-section-I, Part-A, Section-VI.
(Details of references enclosed at Annexure)

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

8.02.00 We further confirm that details in respect of collaboration / valid licencing agreement for the Slurry Recirculation Pumps, between *us/*our sub-vendors, as per 7.01.00 above, and with qualified Slurry Recirculation Pump manufacturer, who meets the requirement stipulated at clause **4.01.01**, sub-section-I, Part-A, Section-VI are enclosed at **Annexure-.....** to this Attachment. The data in respect of provenness criteria for the qualified Slurry Recirculation Pump manufacturer, which is in successful operation in at least one (1) plant for a period not less than one reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder are furnished below.

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

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



TECHNICAL SPECIFICATION OF AGITATORS – NTPC

ANNEXURE-VI – REFERENCE LIST FOR BARH-II (2X 660MW)

REFERENCE LIST as per format shown below. (Atleast two reference plant details)

S.No	Project Name , Customer & Plant capacity	Coal fired Yes/ No	Wet Limestone Based FGD Yes/No	Model	Size of Tank	Type / Hor / Vertical	Speed rpm	Year of Commg	Qty

BIDDER SIGN : _____

DESIGNATION : _____

DATE : _____

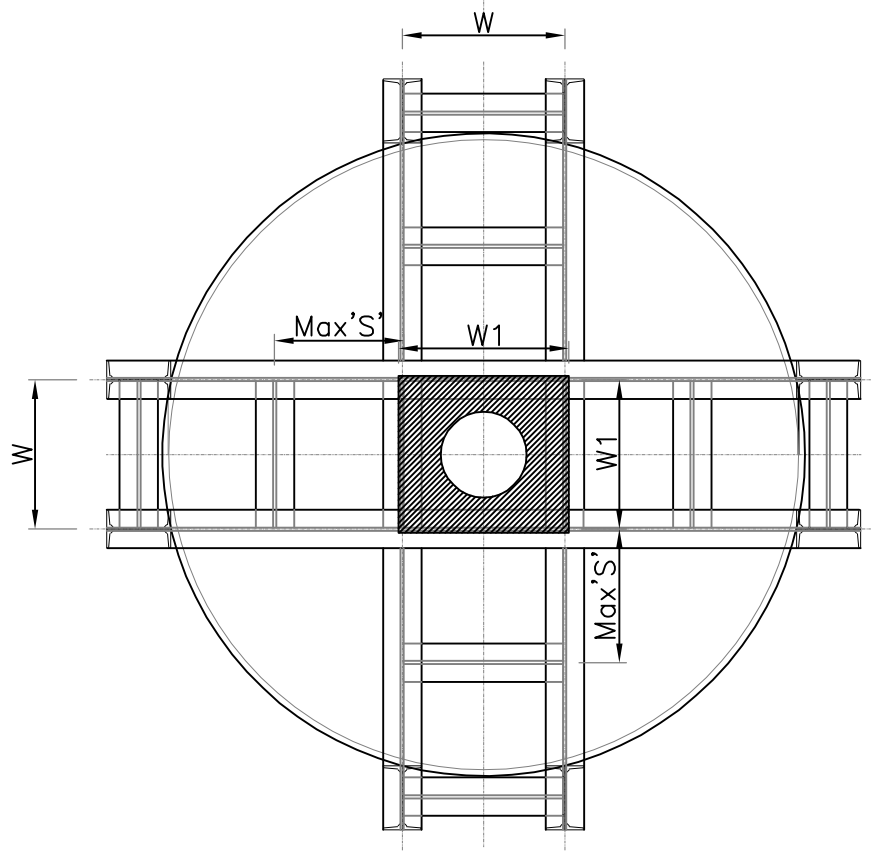
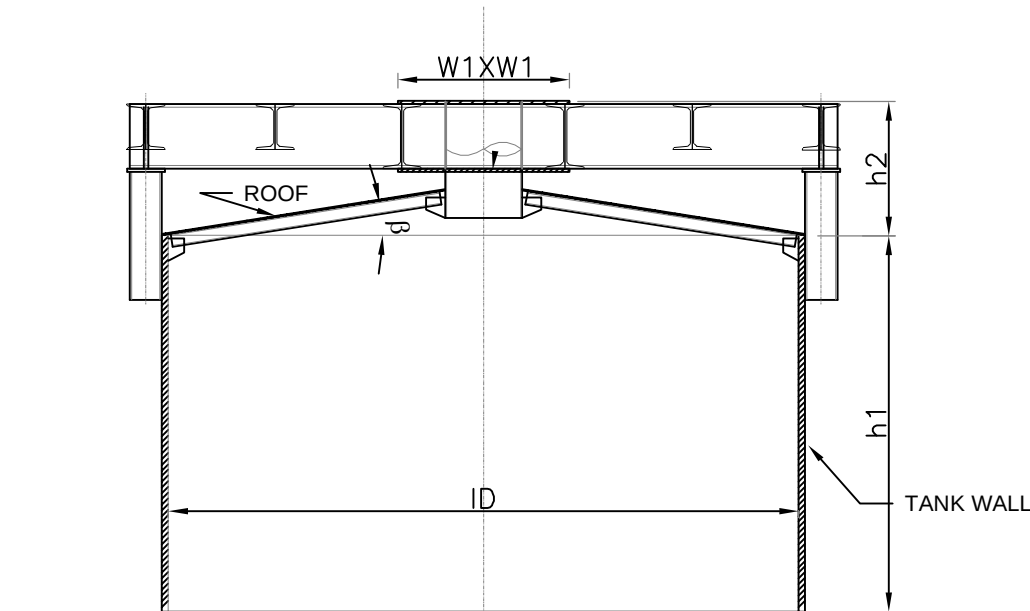
	TECHNICAL INFORMATION OF AGITATOR										
SLNO	Description	ABSORBER AGITATOR	AUXILIARY ABSORBENT TANK AGITATOR	LIMESONE SLURRY STORAGE TANK AGITATOR	PRIMARY HYDROCYCLONE FEED TANK AGITATOR	SECONDARY HYDROCYCLONE FEED TANK AGITATOR	FILTRATE WATER TANK AGITATOR	WASTE WATER TANK AGITATOR	ABSORBER AREA DRAIN SUMP AGITATOR	GYPSUM AREA DRAIN SUMP AGITATOR	LIMESTONE AREA DRAIN SUMP AGITATOR
1	Agitaor slno	1	2	3	4	5	6	7	8	9	10
2	Parameters										
a.	Type	Marine Propeller – Horizontal Type (Side Entry)	Marine Propeller – Horizontal Type (Side Entry)	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)	Vertical Type – (Center Mounted)
b.	Mediume to be handled	Gypsum slurry	Gypsum slurry	Limestone slurry	Gypsum slurry	Gypsum slurry	Gypsum slurry	Gypsum slurry	Gypsum slurry	Gypsum slurry	Limestone slurry
c.	Seal Type	Mechanical Seal	Mechanical Seal (Flushless)	Not required	Not required	Not required	Not required	Not required	Not required	Not required	Not required
	Duty	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous
d.	Agitator location	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor
e.	Operation	Whenever Recirculation Pumps are not running.	Whenever FGD is under maintenance	Continuous.	Continuous.	Continuous.	Continuous.	Continuous.	Continuous.	Continuous.	Continuous.
3	Tank Details										
a.	Tank Name	ABSORBER	AUXILIARY ABSORBENT TANK	LIMESTONE SLURRY STORAGE TANK	PRIMARY HYDROCYCLONE FEED TANK	SECONDARY HYDROCYCLONE FEED TANK	FILTRATE WATER TANK	WASTE WATER TANK	ABSORBER AREA DRAIN SUMP	GYPSUM AREA DRAIN SUMP	LIMESTONE AREA DRAIN SUMP
b.	Capacity of slurry (in m3)	1303m3	1595m3	1391m3	181m3	106m3	92m3	236m3	56m3	56m3	56m3
c.	Dimension (m)	23.9 W X10.9 L X 5H	12.5 Dia X13.8 H	12.0 Dia X 13.1 H	6.0 Dia X 6.9 H	5.0 Dia X 5.9 H	5.0 Dia X 5.2 H	6.5 Dia X 7.6 H	4W X 4L X 4H	4W X 4L X 4H	4W X4L X4H
d.	MOC of Agitator	Agitator Shaft (which is continuously in contact with slurry) and blades shall be made with Alloy 926 or better material	Agitator blades shall be made with Alloy 926 or better material & Agitator shaft can be rubber lined.	Agitator blades shall be made with Alloy 926 or better material & Agitator shaft can be rubber lined.	Agitator blades shall be made with Alloy 926 or better material & Agitator shaft can be rubber lined.	Agitator blades shall be made with Alloy 926 or better material & Agitator shaft can be rubber lined.	Agitator blades shall be made with Alloy 926 or better material & Agitator shaft can be rubber lined.	Agitator blades shall be made with Alloy 926 or better material & Agitator shaft can be rubber lined.	Agitator blades shall be made with Alloy 926 or better material & Agitator shaft can be rubber lined.	Agitator blades shall be made with Alloy 926 or better material & Agitator shaft can be rubber lined.	Agitator blades shall be made with Alloy 926 or better material & Agitator shaft can be rubber lined.
e.	Minimum liquid level in the tank(m)	4.2	1.2	1.0	1.2	1.0	1.2	1.0	1.4	1.4	1.4
f.	Normal liquid level in the tank(m)	5	12.8	12.1	6.2	5.2	4.5	6.9	3.3	3.3	3.3
g.	Maximum liquid level in the tank(m)	6	13	12.3	6.4	5.4	4.7	7.1	3.5	3.5	3.5
h.	Quantity of Agitators per Tank	2 No.s+1 warehouse spare	3 Nos	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.
i.	Total Quantity for two units	6 Nos	3 Nos	2 No.s	1 No.	1 No.	1 No.	1 No.	2 No.s	1 No.	1 No.
3	Slurry Analysis										
a.	Slurry to be handled	Gypsum slurry	Gypsum slurry	Limestone slurry	Gypsum slurry	Gypsum slurry	Gypsum slurry	Gypsum slurry	Gypsum slurry	Gypsum slurry	Gypsum slurry
b.	Maximum solid particle size	200 mesh(75μ)	200 mesh(75μ)	200 mesh(75μ)	200 mesh(75μ)	200 mesh(75μ)	200 mesh(75μ)	200 mesh(75μ)	6-7mm	6-7mm	6-7mm
c.	Normal solid particle size, d50	325 mesh(43μ)	325 mesh(43μ)	325 mesh(43μ)	325 mesh(43μ)	325 mesh(43μ)	325 mesh(43μ)	325 mesh(43μ)	6-7mm	6-7mm	6-7mm
d.	Solid to be handled	GS	GS	LS	GS	GS	GS	GS	GS	GS	GS
e.	Chloride concentration	Max 30000	Max 30000	Max 30000	Max 30000	Max 30000	Max 30000	Max 30000	Max 30000	Max 30000	Max 30000
f.	Hardness of particle	5-7mho Scale	5-7mho Scale	5-7mho Scale	5-7mho Scale	5-7mho Scale	5-7mho Scale	5-7mho Scale	5-7mho Scale	5-7mho Scale	5-7mho Scale
g.	Slurry concentration, wt%	30%	30%	30%	30%	16.60%	11%	3%	30%	30%	30%
h.	Sp. Gravity of slurry	1.213	1.213	1.215	1.213	1.109	1.068	1.02	1.213	1.213	1.215
i.	Sp. Gravity of Lime Stone & Gypsum	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)	2.32(avg)
j.	Viscosity of Slurry	10 CP	10 CP	30 CP	10 CP	4 CP	4 CP	3 CP	10 CP	10 CP	30 CP
k.	pH	4-8	4-8	5-8	4-8	4-8	4-8	4-8	4-8	4-8	5-8
l.	SiO ₂ Content	4 to 6 gl	4 to 6 gl	4 to 6 gl	4 to 6 gl	4 to 6 gl	4 to 6 gl	4 to 6 gl	4 to 6 gl	4 to 6 gl	4 to 6 gl
m.	Temperature	Normal -60.8°C Design- 70°C	Normal -60.8°C Design- 70°C	Normal -45°C Design- 55°C	Normal -60.8°C Design- 70°C	Normal -60.8°C Design- 70°C	Normal -58°C Design - 70°C	Normal -60.8°C Design- 70°C	Normal -60.8°C Design- 70°C	Normal -60.8°C Design- 70°C	Normal -45°C Design- 55°C

AGITATOR SUPPORT IN CIRCULAR TANK

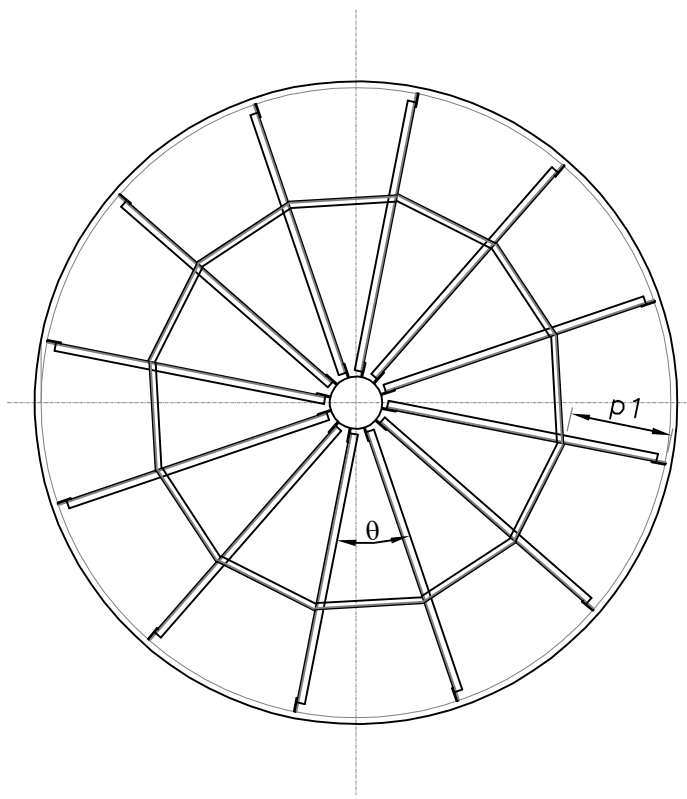
NTPC-BARH-II: 2X660MW

DATE: 27.08.19

SHEET: 01/01



AGITATOR SUPPORT DETAILS

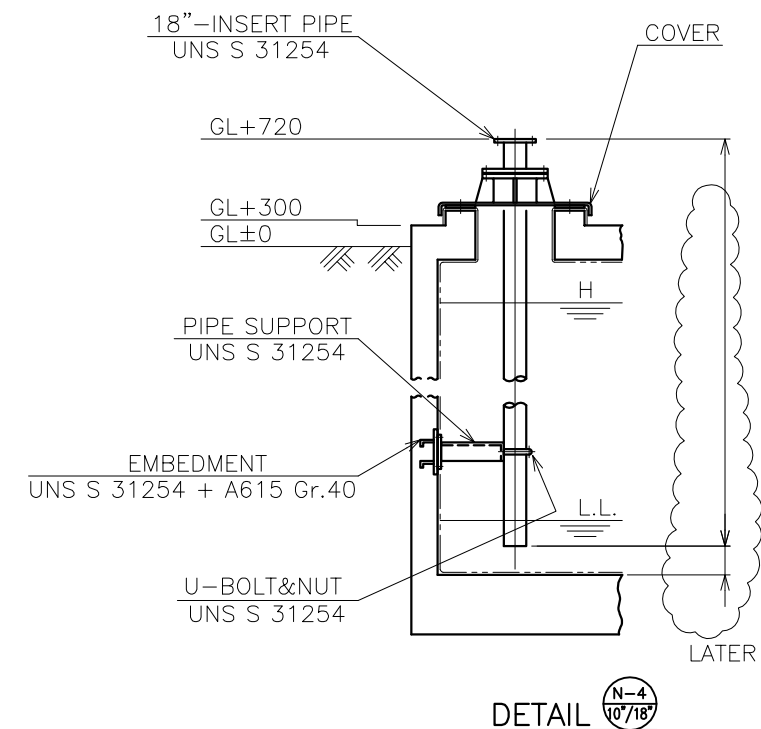
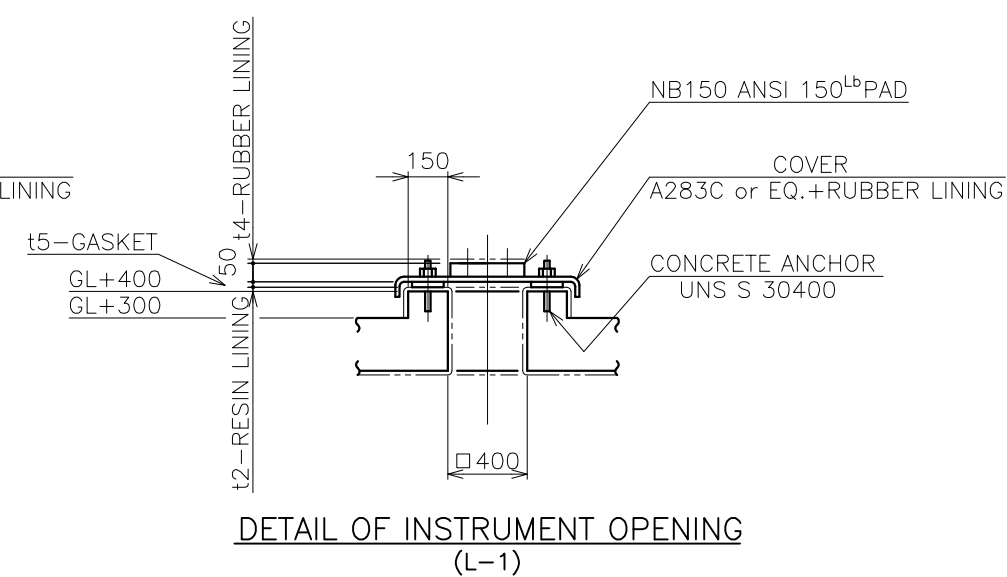


ROOF STIFFENER DETAILS

Note: Baffle plate shall be provided by vendor, Per tank max qty is 4.

SL	TANK	Qty	ID	h1	h2 (tentative)
01	Limestone Slurry Tank	2	12000	13100	1525
02	Aux Absorbent Tank	1	12500	13800	1547
03	Filtrate Water Tank	1	5000	5200	1220
04	Sec Hydro Cyclone Tank	1	5000	5900	1220
05	Waste Water Tank	1	6500	7600	1285
06	Primary Hydro Cyclone Tank	1	6000	6900	1265

FOR FURTHER ACTION



1. DESIGN LOAD OF ROOF : 0.5 t/m^2
DESIGN LOAD OF AGITATOR & PUMP
: REFER TO "LOADING DATA FOR MACHINERY".
2. THE BOTTOM OF SUMP TO BE INCLINED $1/100$
AND TO BE CONSTRUCTED TOWARD PIT.
3. THE MARKED * SHALL BE DECIDED BY OTHERS.

Diagram illustrating the cross-section (SECTION CC) of a concrete structure. The structure features two columns, labeled N-1A and N-1B, and a central void. The total height of the structure is 4000. The central void has a height of 3500. The ground level (GL) is marked as GL+300 and GL±0. The structure is labeled "LATER" and "SLOPE 1 100".

DISTRIBUTION	
BHEL	1
P M (田中)	1
E M (水江)	1
精工品証	1
環境本部 コスト	1
環境本部 SCH	1
環境部設 計課	1
環境部設 計課	1
横空設	1
横土建	1
横電設	1
横計制設	1
横保課	1
横設課	1
計装電氣課	1
MHI ソルテック	1
現地	1
MHI-PEC 豊橋(12F)	1
メーカ	1
控	1
TOTAL	1

MW Rating	(2X660 MW)
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[illegible]

[illegible]

MW Rating (2X660 MW)

[illegible]

[illegible]

Annexure-X-Schedule of Guarantees for BARH-II (2X 660MW)
Project BARH STAGE-I I
MW Rating (2X660 MW)

Sl. No.	Description	Unit	ABSORBER AGITATOR	AUXILIARY ABSORBENT TANK AGITATOR	LIMESONE SLURRY STORAGE TANK AGITATOR	PRIMARY HYDROCYCLONE FEED TANK AGITATOR	SECONDARY HYDROCYCLONE FEED TANK AGITATOR	FILTRATE WATER TANK AGITATOR	WASTE WATER TANK AGITATOR	ABSORBER AREA DRAIN SUMP AGITATOR	GYPSUM AREA DRAIN SUMP AGITATOR	LIMESTONE AREA DRAIN SUMP AGITATOR
1	Rated Input Power at Motor Terminal at Normal water level and at Normal voltage and Frequency (*)	KW										
2	Possible Rate of deposit of solid particles at tank bottom of total solid particle inflow/outflow	%										
2	Noise level at a distance of 1.0 meter from the equipment at site	dB(A)	85	85	85	85	85	85	85	85	85	85
3	Maximum vibration velocity at site) (RMS)	mm/sec	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
4	Life of Agitator components parts from the date of Commissioning for continuous operation		24 months	24 months	24 months	24 months	24 months	24 months	24 months	24 months	24 months	24 months
	Anti-friction Bearing		25000 hrs.	25000 hrs.	25000 hrs.	25000 hrs.	25000 hrs.	25000 hrs.	25000 hrs.	25000 hrs.	25000 hrs.	25000 hrs.

BID EVALUATION CRITERIA FOR POWER
CONSUMPTION
LIQUIDATED DAMAGES FOR POWER
CONSUMPTION

Power Loading
: Per KW (PL) 133315 INR
Penalty Per
: KW(P) 133315 INR



TECHNICAL SPECIFICATION OF AGITATORS – NTPC

ANNEXURE XI- LIST OF DEVIATIONS OR EXCEPTIONS TO THE ENQUIRY DOCUMENT FOR BARH-II (2X 660MW)

* We hereby accept to the Technical Specification for agitators Ref **NTPC:FGD:AGITATORS:R00** and all the parameters for this project.

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----

(OR)

*The following are the technical deviations to the specification:

SI No	Clause No	Page No	Description of Deviation

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----

*Strike out whichever is not applicable



TECHNICAL SPECIFICATION OF AGITATORS – NTPC PROJECTS

Annexure-XII- Mandatory Spare list for BARH-II (2X 660MW)

i) Mandatory Spares for Agitators of Absorber tank and Aux.Absorbent tank

S. No	Item Description	Qty
1	Impeller Assembly	1 no. of each type and size
2	Bearing Assembly	1 no. of each type and size
3	Motor	1 no. of each type and size
4	Belt and Pulley (If applicable)	1 no. of each type and size
5	Gear Box Assembly (If Applicable)	1 no. of each type and size
6	Agitator Shaft Assembly	1 no. of each type and size
7	Shaft seal	1 no. of each type and size
8	Complete Agitator assembly	1 no. of each type and size

ii) Mandatory Spares for Agitators of all other tanks

S. No	Item Description	Qty
1	Impeller Assembly	1 nos. of each type
2	Bearing Assembly	1 nos. of each type
3	Motor	1 nos. of each type
4	Belt and Pulley (If applicable)	1 nos. of each type
5	Gear Box Assembly (If Applicable)	1 nos. of each type
6	Shaft seal	1 no. of each type and size
7	Complete Agitator assembly	1 no. of each type and size

Bidder to submit the applicable spares along with Prices in the Price schedule.

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----

Mandatory Price Schedule for BARH-II (2X 660MW)
PROJECT : BARH-II (2X660 MW)

S. No	Item Description	Qty	ABSORBER AGITATOR	AUXILIARY ABSORBENT TANK AGITATOR
1	Impeller Assembly	1 no. of each type and size		
2	Bearing Assembly	1 no. of each type and size		
3	Motor	1 no. of each type and size		
4	Belt and Pulley (If applicable)	1 no. of each type and size		
5	Gear Box Assembly (If Applicable)	1 no. of each type and size		
6	Agitator Shaft Assembly	1 no. of each type and size		
7	Shaft seal	1 no. of each type and size		
8	Complete Agitator assembly	1 no. of each type and size		
(i)	Mandatory Spares for Agitators of Absorber tank and Aux.Absorbent tank	1 SET	0	

S. No	Item Description	Qty	LIMESONE SLURRY STORAGE TANK AGITATOR	PRIMARY HYDROCYCLONE FEED TANK AGITATOR	SECONDARY HYDROCYCLONE FEED TANK AGITATOR	FILTRATE WATER TANK AGITATOR	WASTE WATER TANK AGITATOR	ABSORBER AREA DRAIN SUMP AGITATOR	GYPSUM AREA DRAIN SUMP AGITATOR	LIMESTONE AREA DRAIN SUMP AGITATOR
1	Impeller Assembly	1 nos. of each type								
2	Bearing Assembly	1 nos. of each type								
3	Motor	1 nos. of each type								
4	Belt and Pulley (If applicable)	1 nos. of each type								
5	Gear Box Assembly (If Applicable)	1 nos. of each type								
6	Shaft seal	1 no. of each type and size								
7	Complete Agitator assembly	1 no. of each type and size								
(ii)	Mandatory Spares for Agitators of other tanks	1 SET	0							

*Bidder to clearly indicate whether quoted/not quoted
If not quoted, bidder to give reason giving the type and model which are same.

**ANNEXURE-I- TECHNICAL
SPECIFICATION FOR MOTORS**

CLAUSE NO.	SPECIFICATION FOR MOTORS		एनटीपीसी NTPC
TECHNICAL REQUIREMENTS			
MOTORS			
1.00.00	GENERAL REQUIREMENTS		
1.01.00	For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment.		
1.02.00	All equipment's shall be suitable for rated frequency of 50 Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.		
1.03.00	Contactor shall provide fully compatible electrical system, equipment's, accessories and services.		
1.04.00	All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.		
1.05.00	Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.		
1.06.00	The responsibility of coordination with electrical agencies and obtaining all necessary clearances for Contactors equipment and systems shall be under the Contactor scope.		
1.07.00	Degree of Protection		
	Degree of protection for various enclosures as per IEC60034-05 shall be as follows :-		
	i)	Indoor motors	- IP 54
	ii)	Outdoor motors	- IP 55
	iii)	Cable box-indoor area	- IP 54
	iv)	Cable box-Outdoor area	- IP 55
2.00.00	CODES AND STANDARDS		
	1)	Three phase induction motors	: IS/IEC:60034
	2)	Single phase AC motors	: IS/ IEC:60034
	3)	Crane duty motors	: IS:3177, IS/IEC:60034
	4)	DC motors/generators	: IS:4722, IS/IEC:60034
	5)	Energy Efficient motors	: IS 12615, IEC:60034-30

CLAUSE NO.	TECHNICAL REQUIREMENTS
3.00.00	TYPE
3.01.00	AC Motors: - Squirrel cage induction motor suitable for direct-on-line starting. - Continuous duty LT motors upto 200 KW Output rating (at 50 deg.C ambient temperature), shall be Premium Efficiency class-IE3, conforming to IS 12615, or IEC:60034-30. - Crane duty motors shall be slip ring/ squirrel cage Induction motor as per the requirement. - Motor operating through variable frequency drives shall be suitable for inverter duty. Also these motors shall comply the requirements stipulated in IEC: 60034-18-41 and IEC: 60034-18-42 as applicable.
3.02.00	DC Motors Shunt wound.
4.00.00	RATING
	- Continuously rated (S1). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor. - Whenever the basis for motor or driven equipment ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations.
5.00.00	TEMPERATURE RISE
	Air cooled motors 70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation. Water cooled 80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation.
6.00.00	OPERATIONAL REQUIREMENTS
6.01.00	Starting Time
6.01.01	For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.
6.01.02	For motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than starting time.

CLAUSE NO.	TECHNICAL REQUIREMENTS
6.01.03	For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.
6.01.04	Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.
6.02.00	Torque Requirements
6.02.01	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.
6.02.02	Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.
6.03.00	Starting voltage requirement (a) Up to 85% of rated voltage for ratings below 110 KW (b) Up to 80% of rated voltage for ratings from 110 KW to 200 KW (c) Up to 85% of rated voltage for ratings from 201 KW to 1000 KW (d) Up to 80% of rated voltage for ratings from 1001 KW to 4000 KW (e) Up to 75 % of rated voltage for ratings above 4000KW
7.00.00	DESIGN AND CONSTRUCTIONAL FEATURES
7.01.00	Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided. However for flame proof motors, space heater terminals inside the main terminal box may be acceptable.
7.02.00	All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). The method of movement of primary and secondary coolant shall be self-circulated by fan or pump directly mounted on the rotor of the main motor as per IEC 60034-6. However VFD driven motors can be offered with forced cooling type with machine mounted fan or pump driven by separate electric motor. Motors and EPB located in hazardous areas shall have flame proof enclosures conforming to IS:2148 as detailed below (a) Fuel oil area : Group – IIB (b) Hydrogen generation : Group - IIC or (Group-I, Div-II as per plant area NEC) or (Class-1, Group-B, Div-II as per NEMA /IEC60034)

CLAUSE NO.	TECHNICAL REQUIREMENTS
7.03.00	Winding and Insulation (a) Type : Non-hygroscopic, oil resistant, flame resistant (b) Starting duty : Two hot starts in succession, with motor initially at normal running temperature. (c) 11kV & 3.3 kV AC motors : Thermal class 155 (F) insulation. The winding insulation process shall be total Vacuum Pressure Impregnated i.e resin poor method. The lightning Impulse & interturn insulation surge withstand level shall be as per IEC-60034 part-15. (d) 240VAC, 415V AC & 220V DC motors : Thermal Class (B) or better 7.04.00 Motors rated above 1000KW shall have insulated bearings to prevent flow of shaft currents. 7.05.00 Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature. 7.06.00 Noise level for all the motors shall be limited to 85 dB(A) except for BFP motor for which the maximum limit shall be 90dB(A). Vibration shall be limited within the limits prescribed in IS:12075 / IEC 60034-14 . Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads. 7.07.00 In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer with adjustable alarm contact and preferably 2 numbers duplex platinum resistance type temperature detectors. 7.08.00 Motor body shall have two earthing points on opposite sides. 7.09.00 11 KV motors shall be offered with Separable Insulated Connector (SIC) as per IEEE 386. The offered SIC terminations shall be provided with protective cover and trifurcating sleeves. SIC termination kit shall be suitable for fault level of 25 KA for 0.17 seconds. 7.10.00 3.3 KV motors shall be offered with dust tight phase separated double walled (metallic as well as insulated barrier) Terminal box. Employer shall provide termination kit for the offered Terminal box. The offered Terminal Box shall be suitable for fault level of 250 MVA for 0.12 sec. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) shall be provided.

CLAUSE NO.	TECHNICAL REQUIREMENTS																
7.11.00	The spacing between gland plate & centre of terminal stud shall be as per Table-I.																
7.12.00	All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.																
7.13.00	The motors shall be suitable for bus transfer schemes provided on the 11kV, 3.3 kV /415V systems without any injurious effect on its life.																
7.14.00	For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.																
7.15.00	The size and number of cables (for HT motors) to be intimated to the successful Contactor during detailed engineering and the Contactor shall provide terminal box suitable for the same.																
8.00.00	The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance): <table><tr><td>(a) From 50KW & upto 110KW</td><td>:</td><td>11.0</td></tr><tr><td>(b) From 110 KW & upto 200 KW</td><td>:</td><td>9.0</td></tr><tr><td>(c) Above 200 KW & upto 1000KW</td><td>:</td><td>10.0</td></tr><tr><td>(d) From 1001KW & upto 4000KW</td><td>:</td><td>9.0</td></tr><tr><td>(e) Above 4000KW</td><td>:</td><td>6 to 6.5</td></tr></table>	(a) From 50KW & upto 110KW	:	11.0	(b) From 110 KW & upto 200 KW	:	9.0	(c) Above 200 KW & upto 1000KW	:	10.0	(d) From 1001KW & upto 4000KW	:	9.0	(e) Above 4000KW	:	6 to 6.5	
(a) From 50KW & upto 110KW	:	11.0															
(b) From 110 KW & upto 200 KW	:	9.0															
(c) Above 200 KW & upto 1000KW	:	10.0															
(d) From 1001KW & upto 4000KW	:	9.0															
(e) Above 4000KW	:	6 to 6.5															
10.00.00	TYPE TEST																
10.01.00	HT MOTORS																
10.01.01	The Contactor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The Contactor shall indicate the charges for each of these type tests separately in the relevant schedule of Section - VII- (BPS) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the Employer's engineer.																
10.01.02	The type tests shall be carried out in presence of the Employer's representative, for which minimum 15 days notice shall be given by the Contactor. The Contactor shall obtain the Employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set-up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.																
10.01.03	In case the Contactor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering																

CLAUSE NO.	TECHNICAL REQUIREMENTS 
10.01.04 10.01.05 10.01.06	the type test reports to the Employer for waiver of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The Employer reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the Contactor. Further the Contactor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED" and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the Contactor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the Contactor shall conduct all such tests under this contract at no additional cost to the Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval. LIST OF TYPE TESTS TO BE CONDUCTED The following type tests shall be conducted on each type and rating of HT motor (a) No load saturation and loss curves upto approximately 115% of rated voltage (b) Measurement of noise at no load. (c) Momentary excess torque test (subject to test bed constraint). (d) Full load test(subject to test bed constraint) (e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp.,coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose. LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED The following type test reports shall be submitted for each type and rating of HT motor (a) Degree of protection test for the enclosure followed by IR, HV and no load run test.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	(b) Terminal box-fault level withstand test for each type of terminal box of HT motors only. (c) Lightning Impulse withstand test on the sample coil shall be as per clause no. 4.3 IEC-60034, part-15 (d) Surge-withstand test on inter-turn insulation shall be as per clause no. 4.2 of IEC 60034, part-15
10.02.00	LT Motors
10.02.01	LT Motors supplied shall be of type tested design. During detailed engineering, the Contactor shall submit for Employer's approval the reports of all the type tests as listed in this specification and carried out within last <i>ten</i> years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.
10.02.02	However if the Contactor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the Contactor shall conduct all such tests under this contract at no additional cost to the Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval.
10.02.03	LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only 1. Measurement of resistance of windings of stator and wound rotor. 2. No load test at rated voltage to determine input current power and speed 3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors) 4. Full load test to determine efficiency power factor and slip 5. Temperature rise test 6. Momentary excess torque test. 7. High voltage test 8. Test for vibration severity of motor. 9. Test for noise levels of motor(Shall be limited as per clause no 7.06.00 of this section)

CLAUSE NO.	TECHNICAL REQUIREMENTS 
	10. Test for degree of protection and 11. Overspeed test. 12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1 10.03.00 All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price. 10.04.00 The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.

CLAUSE NO.

TECHNICAL REQUIREMENTS



TABLE - I

DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS

Motor MCR in KW of	Minimum distance between centre stud and gland plate in mm As per manufacturer's practice.
-------------------------------	---

UP to 3 KW

Above 3 KW - upto 7 KW	85
Above 7 KW - upto 13 KW	115
Above 13 KW - upto 24 KW	167
Above 24 KW - upto 37 KW	196
Above 37 KW - upto 55 KW	249
Above 55 KW - upto 90 KW	277
Above 90 KW - upto 125 KW	331
Above 125 KW-upto 200 KW	203

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

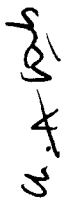
PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:

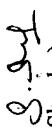
NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:

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

LT MOTOR APPROVED VENDORS ARE GIVEN BELOW. MANUFACTURER HAS TO SUBMIT THE SUB VENDOR QUESTIONNAIRE IF THE MOTOR MANUFACTURER IS NOT AS PER THE LIST GIVEN BELOW. MOTOR MANUFACTURER WILL BE SUBJECT TO NTPC APPROVAL.

04	LT MOTORS	a) KEC c) CGL b) SIEMENS c) ABB a) BBL b) NGEF c) Marathon d) Jyoti e) LHP (For other PMD vendors except above NTPC approved vendors, pl refer S/no. 4 under important notes in page no:11)	Bangalore/Hubli (Up to 90KW) Ahmednagar Mumbai Faridabad up to 55KW/ Bangalore above 55KW Mumbai Hubli (up to 15KW) Kolkata Vadodara Solapur	Please refer remark column for Categorization	BAP/QR/ G501 & G502 /LTM:012 Rev NO: 00 dt 17 05 2018	Cat I Above 50 KW and up to 200KW NTPC inspn as per appd RQP/MQP Cat-II **From 30KW to 50KW BHEL Inspection # Cat-III Up to 30KW
				Please refer remark column for Categorization	** Acceptance of Motor rating between 30KW to 50 KW is based on NTPC Review of Routine Test Inspection report as per IS 325 Witnessed by BHEL/BHEL AIA ie Main contractor along with COC of the manufacturer and the contractor confirming as follows: "It is hereby confirmed that the above mentioned motor was /motors were manufactured taking care of NTPC specific requirements regarding ambient temperature, voltage and frequency variation, hot starts , pull out torque, starting KVA/KW, temperature rise, distance between centre of stud and gland plate, space heater and in accordance with approved drawing /data sheets" ##Acceptance of Motor less than 30KW is based on COC of the manufacturer and the contractor conforming as follows: "It is here by confirmed that the above mentioned motor/motor was / were manufactured taking care of NTPC specific requirements regarding ambient temperature, voltage and frequency variation, hot starts , pull out torque, starting KVA/KW, temperature rise ,distance between centre of stud and gland plate and tested in accordance with approved drawing /data sheet".	

Prepared by: 
(Ch. Anil Singh)
Dy. Engineer/QA (Electrics)

Reviewed by: 
(S. Sheela)
Dy. Manager/QA (Electrics) & Syst

Approved by: 
(K. Gandhi Parimalam)
DGM / QA (Electrics)



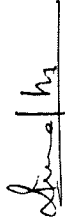
CORPORATE QUALITY ASSURANCE
SUB-VENDOR QUESTIONNAIRE

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

	CORPORATE QUALITY ASSURANCE SUB-VENDOR QUESTIONNAIRE
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10.	Quality Control exercised during receipt of raw material/BOI, in-process , Final Testing, packing	Details attached at Annexure – F2.6				
11.	Manufacturing facilities (List of machines, special process facilities, material handling etc.)	Details attached at Annexure – F2.7				
12.	Testing facilities (List of testing equipment)	Details attached at Annexure – F2.8				
13.	If manufacturing process involves fabrication then-	Applicable / Not applicable				
	List of qualified Welders	Details attached at Annexure – F2.9				
	List of qualified NDT personnel with area of specialization	(if applicable)				
14.	List of out-sourced manufacturing processes with Sub-Vendors' names & addresses	Applicable / Not applicable				
		Details attached at Annexure. –F2.10 (if applicable)				
15.	Supply reference list including recent supplies	Details attached at Annexure – F2.11 (as per format given below)				
	Project/ package	Customer Name	Supplied Item (Type/Rating/Model /Capacity/Size etc)	PO ref no/date	Supplied Quantity	Date of Supply
16.	Product satisfactory performance feedback letter/certificates/End User Feedback	Attached at annexure - F2.12				
17.	Summary of Type Test Report (Type Test Details, Report No, Agency, Date of testing) for the proposed product (similar or higher rating) Note:- Reports need not to be submitted	Applicable / Not applicable				
		Details attached at Annexure – F2.13 (if applicable)				
18.	Statutory / mandatory certification for the proposed product	Applicable / Not applicable				
		Details attached at Annexure – F2.14 (if applicable)				
19.	Copy of ISO 9001 certificate (if available)	Attached at Annexure – F2.15				
20.	Product technical catalogues for proposed item (if available)	Details attached at Annexure – F2.16				
Name:		Desig:		Sign:		Date:

Company's Seal/Stamp:-

MANUFACTURER'S NAME AND ADDRESS		STANDARD QUALITY PLAN											
 Ranipet M/S BHEL: BAP: RANIPET 632 406 TAMIL NADU		ITEM: AGITATOR		QP NO:		FGS: 720							
		SYSTEM: FGD		REV. NO:		00							
				DATE:		12.02.2019							
				PAGE NO:		Page 1 of 2							
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY		REMARKS	
					M	C/N				M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	** 10.		11.	
1.0 RAW MATERIAL INSPECTION													
1.1	All materials including casting & forgings	Chem. & Mech. Dimensions Surface Defects	MA MA MA	Review of MTC Measurement Visual	1/Heat 100% 100% 100%	1/Heat - - -	As per spec. & Appd. Dwg	TC IR IR	✓ P P	V - -	V - -		
2.0 MOTOR : REVIEW OF MANUFACTURE TEST CERTIFICATE													
3.0 IN PROCESS INSPECTION													
3.1	Welding Qualifications	WPS & PQR	MA	WPS, PQR & WPQ	100%		ASME Sec IX	IR	✓	P	V	V	Recent qualified WPS, PQR and WPQ shall be submitted for review during inspection
3.2	Marking, Cutting, Edge Preparation Tacking	Dimensions	MA	Measurement	100%		Appd.Dwg.	IR		P	-	-	
3.3	Welds	Dimensions & Surface Quality	MA	Measurement	100%		Appd.Dwg. & ASME Sec VIII	IR	✓	P	W	V	
3.4	Machining of Components	Dimensions Surface Defects	MA	Measurement Visual	100% 100%		Appd. Dwg.	IR		P P	- -	- -	
3.5	Impeller	Static balance test	MA	Measurement	100%		As per Specs.	TR	✓	P	V	V	
3.6	Rubber Lining	Hardness test & Spark test	MA	Measurement	100%		Appd. Drg	TR	✓	P	W	V	
3.7	Assembly	Dimensions Completeness	MA	Measurement Visual	100% 100%		Appd.Drg.	IR	✓	P P	V V	V V	
4.0 FINAL INSPECTION													
4.1	Final Assembly	Overall Dimensions & Completeness	MA MA	Measurement Visual	100% 10%		Appd. Dwg	IR	✓	P	W	V	*10% pf each type (Vertical / Horizontal)
PREPARED BY  Rakesh Kumar Madhu, (SEr/QA)							REVIEWED & APPROVED BY  K C Gandhi Parimalam, (DGM/QA)						

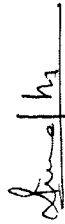
LEGEND: * RECORD, IDENTIFIED WITH "TICK" (✓) UNDER COLUMN 'D' SHALL BE SUBMITTED TO CUSTOMER AS A QA DOCUMENTATION PACKAGE.
M: MANUFACTURER / SUB SUPPLIER, **C:** MAIN CONTRACTOR.
N: CUSTOMER/CONSULTANT **P:** PERFORM **W:** WITNESS **V:** REVIEW OF RECORDS
MA: MAJOR AND **MI:** MINOR

Quality plan is only Sample . Inspection will be done as per Quality plan approved by NTPC during contract.

MANUFACTURER'S NAME AND ADDRESS		STANDARD QUALITY PLAN										
M/S BHEL: BAP: RANIPET 632 406 TAMIL NADU		ITEM: AGITATOR SYSTEM: FGD		QP NO:		FGS: 720		REV. NO:		00		
				DATE:		12.02.2019		PAGE NO:		Page 2 of 2		
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY		REMARKS
					M	C/N				M	C	N
1.	2.	3.	4.	5.	6.		7.	8.	9.	** 10.		11.
4.2	Free Air Run Test of complete assembly	Measurement Current, RPM, Noise & Vibration	MA	Measurement	100%	10%	Vendor Standard / Approved Drawing / Data Sheet		IR	✓	P	W
4.3	Review of QA Documents	Verification of QA Documents	MA	Verification	100%	100%	As per Appd. MQP		IR		P	V
5.0 PAINTING & PRESERVATION												
5.1		Painting Material	MI	Review of MTC	100%		Appd. "Painting Procedure"/Approved Painting Schedule		IR	✓	P	V
5.2		Surface treatment and inspection	MI	Visual	100%	-	-do-		IR	✓	P	-
5.3		DFT Check	MI	Measurement	10%		-do-		IR	✓	P	V
5.4		Painting Surface Quality	MI	Visual	100%		-do-		IR	✓	P	V
6.0 INSPECTION BEFORE DELIVERY												
6.1	Packing	Size, appearance & firmness	MI	Measurement & Visual	100%		As per "Packing Procedure"		IR	✓	P	V
6.2	Deliver Documents	Markings, Packing List & Details Packing List, etc., Check	MI	Verification	100%		As per "Packing Procedure"		IR	✓	P	V

NOTES:

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

LEGEND: * RECORD, IDENTIFIED WITH "TICK" (✓) UNDER COLUMN 'D' SHALL BE SUBMITTED TO CUSTOMER AS A QA DOCUMENTATION PACKAGE. M: MANUFACTURER / SUB SUPPLIER, C: MAIN CONTRACTOR. N: CUSTOMER/CONSULTANT P: PERFORM W: WITNESS V: REVIEW OF RECORDS MA: MAJOR AND MI: MINOR		PREPARED BY  Rakesh Kumar Madhu,(SEr/QA)	REVIEWED & APPROVED BY  K C Gandhi Parimalam,(DGM/QA)
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Annexure to Enquiry no:		Date
Sl.No	BHEL / Customer Requirement	##Specific confirmations by the manufacture
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 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 preaward / 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 : (a) Latest revision of Standards & Specification shall apply. Only International Standards are applicable. Indian & Chinese Standards are not applicable (b) Materials shall be procured in compliance to Functional Technical Specification. (c) Inspection shall be in compliance with Approved Quality Control Procedure for the Product. (d) NDT shall be carried out by Qualified Personnel with compliance to Approved NDT Procedures and Acceptance Norms, as per ASME Section V. (e) Gauges and measuring Instruments, with valid calibration only shall be used. (f) Cleaning and Painting of products shall be carried out as per Approved Painting Schedule. (g) Finished Products shall be packed to comply with Approved Packing Schedule. (h) Welding shall be carried out by Qualified Personnel with compliance to Approved NDT Procedures and Acceptance Norms, as per ASME Section V.	
2	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).	
3	Inspection Agency for Foreign Bidders and also for Indian Bidder but importing from Foreign Sources: (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. (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. <u>List of TPIA</u> 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 SGS 7. M/s Germanischer Lloyd 8. M/s QUEST 9. M/s Certification Engineers International 10. M/s Intertek 11. M/s IR Class Systems and Solutions 12. M/s DNV 13. M/s Fichtner 14. M/s ABS Inspection Services	
4	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 (atleast 2 weeks before) to TPI/Bidder's own inspection agency to avoid delay in the manufacturing processes.	

Sl.No	BHEL / Customer Requirement	##Specific confirmations by the manufacture
5	Inspection before despatch for domestic supplier : Inspection before despatch 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 .	
6	Inspection at Foreign Source/Supplier: (a) As in sl no: 3. shall be ensured without fail (b) No materail / items shall be despatched without getting the written communication from BHEL / Customer inspection carried out by BHEL/BHEL apointed Third Party Inspection Agency (TPIA) / Customer/Customer Apointed Inspection Agency/Consulatnat. 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 Instrumentaion Diagram / Process Flow Diagram / Single Line Diagram) etc (As applicable). Inspection before despatch for Foreign supplier : Inspection before despatch 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.	
7	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 advavnce before proceding including the BOI being procured for assy / skid like motors etc	
8	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 + Mechnaical + HT + NDT etc (v) Third party Inspection report + TC (vi) Customer CHP/ MDCC (vii) Type test / Performance Test reports conducted (viii) Type test / Performance Test approval/ clearance obtained from BHEL/Customer (ix) BOM with As Build Drgs 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 tarnsit / handling / transhipment in Road / Sea / Air. Photographs are to be submitted for BHEL review before despatching 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 accreadted 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	## Necessorily 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.	



TECHNICAL SPECIFICATION OF AGITATORS – NTPC

NTPC:FGD:AGITATORS:R00

ANNEXURE-III

PROJECT : BARH-I (3 X 660 MW)

COMPLIANCE TO SEAWORTHY PACKING (APPLICABLE FOR SHIPMENTS FROM OUTSIDE INDIA)

We hereby accept to the Specification No: PE-TS-888-100-A001 for Seaworthy packing.

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----