
TECHNICAL SPECIFICATION FOR RECIRCULATION PUMPS

CONFIDENTIAL

CUSTOMER	: NATIONAL THERMAL POWER CORPORATION(NTPC)
PROJECT	: BARH-II 2x660MW
APPLICATION	: FLUE GAS DESULPHURIZATION SYSTEM



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

	TECHNICAL SPECIFICATION OF RECIRCULATION PUMP BARH-II (2X660 MW)
BARH-II:FGD:ARP:R00	

TECHNICAL SPECIFICATION FOR RECIRCULATION PUMP

Prepared	Checked	Approved
<u>A. Kumar</u> Abhinav Kumar Sr. Engineer-WS	<u>Harshdeep</u> Harshdeep / DM-WS <u>J. M. Ramakrishna</u> IMRL Rao, Sr. Mgr- WS	<u>M. Ramakrishna</u> 28/09/2019 M. Ramakrishna AGM- WS
Revision – 00 Dated 28-09-2019	COMMENTS : ----	

This document is meant for the exclusive purpose of bidding against this specification and shall not be transferred, reproduced or otherwise used for purposes other than that for which it is specifically issued.



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BARH-II (2X660 MW)**

BARH-II:FGD:ARP:R00

CONTENTS

1.0	PROJECT INFORMATION
2.0	APPLICABLE CODES & REGULATIONS
3.0	INTENT OF SPECIFICATION
4.0	PROVENNESS CRITERIA
5.0	TECHNICAL INFORMATION
6.0	SCOPE OF SUPPLY
7.0	GENERAL REQUIREMENTS
8.0	PACKING & FORWARDING
9.0	SUPERVISION OF ERECTION, TESTING & COMMISSIONING
10.0	EXCLUSION
11.0	INSPECTION AND TESTING
12.0	PAINTING
13.0	SPARES, TOOLS & TACKLES
14.0	PERFORMANCE GUARANTEE
15.0	DEFECT LIABILITY
16.0	FIRST FILL OF CONSUMABLES
17.0	TRAINING
18.0	CONFLICT
29.0	DOCUMENTATION
20.0	ANNEXURES

	TECHNICAL SPECIFICATION OF RECIRCULATION PUMP BARH-II (2X660 MW)
BARH-II:FGD:ARP:R00	

1.0 PROJECT INFORMATION:

Barh-II Thermal Power Project (2x660 MW), a pithead coal based thermal power project, is located in Patna districts of Bihar State. Basic inputs i.e. coal; water and land have already been tied up. The project is proposed for the States & Union Territories of Northern, Western and Eastern Regions and the State of Jharkhand. The capacity of the project is 660 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) The above site conditions shall apply for the Guarantee Values as well as for the Guarantee test/Performance test
- 2) Equipment and Material must be suitable for the range of ambient site conditions.

B) PROJECT LOCATION AND APPROACH

a.	State/Division	Bihar
b.	District	Patna

2.0 APPLICABLE CODES & REGULATIONS

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

- IS: 1520: Horizontal centrifugal pumps for clear cold fresh water



TECHNICAL SPECIFICATION OF RECIRCULATION PUMP BARH-II (2X660 MW)

BARH-II:FGD:ARP:R00

- IS: 5120: Technical requirements of rotor dynamic special purpose pumps
- API:610: Centrifugal pumps for general refinery service
- IS:5639: Pumps handling chemicals & corrosion liquids
- IS:5659: Pumps for process water
- HIS: Hydraulic Institute Standards USA
- ASTM-1-165-65: Standard methods for Liquid Penetration Inspection

3.0 INTENT OF SPECIFICATION

This specification covers the minimum requirements for the complete design, material, manufacturing, shop inspection, performance testing at the manufacturer's works, delivery supervision of erection & performance testing at bidder's works of Recirculation pump along with accessories which is furnished in the Flue Gas Desulphurization plant of Barh II 2x660 MW FGD system. The following points may be noted.

- a. Total 10 nos of Recirculation pumps are required .i.e. 5 Nos of RC pumps per unit.
- b. Bidder shall assume full responsibility for the entire equipment assembly and make all possible efforts to comply strictly with the requirements of this specification and other specifications/attachments to inquiry/order.
- c. The Bidder shall offer only proven design which meets the Provenness criteria indicated in the Annexure-I. Necessary document evidences as per Attachment-3K for qualification shall be submitted along with the bid. If bidder does not meet the specified provenness criteria, they are denied to participate in this tender.
- d. In case, deviations are considered essential by the Bidder (after exhausting all possible efforts), the same shall be separately listed in the Bidder's proposal under separate section, titled as "List of Deviations/Exceptions to the Enquiry Document (Annexure-IV)".
- e. Any deviation, not listed under the above section, even if reflected in any other portion of the proposal, shall not be considered applicable.
- f. No deviation or exception shall be permitted without the written approval of the purchaser.
- g. Compliance to this specification shall not relieve the Bidder of the responsibility of furnishing equipment and accessories/auxiliaries of proper design, materials and workmanship to meet the specified start up and operating conditions.
- h. In case, the Bidder considers requirement of additional instrumentation, controls, safety devices and any other accessories/auxiliaries essential for safe and satisfactory operation of the equipment, the same shall be recommended along with reasons in a separate section and include the same in scope of supply.
- i. All accessories, items of work, though not indicated but required to make the system complete for its safe, efficient, reliable and trouble free operation and maintenance shall also be in supplier's scope unless specifically excluded.

4.0 PROVENNESS CRITERIA:

The Bidders are required to meet the Qualification Requirement (QR) for Recirculation Pumps as per Annexure-I & submit the Annexure to qualification requirement (Attachment-3K). Offer will be rejected if bidder is not meeting the Qualification Criteria.

	TECHNICAL SPECIFICATION OF RECIRCULATION PUMP BARH-II (2X660 MW)
BARH-II:FGD:ARP:R00	

5.0 TECHNICAL INFORMATION

S.No	Description	Requirement
1.	Quantity	
	Quantity of Recirculation Pumps for Unit-1	5 no's (4 working + 1 standby)
	Quantity of Recirculation Pumps for Unit-2	5 no's (4 working + 1 standby)
	Total	10 no's
2.	Parameters	
	Pump Design capacity	11750 m ³ /hr.
	Pump Head Developed	17.9 m H
	Medium to be handled	Gypsum slurry
	Operating Temperature	~61 deg C
	Slurry Analysis	Refer Clause 5.1
	Type of Recirculation pump	Impeller Centrifugal (non- Clogging) type
	Nozzle Orientation	End Suction- Top Discharge
	Seal Type	Single Mechanical seal
	Duty	Continuous
	Location	Outdoor
3.	POWER SUPPLY	
	The following voltage levels shall apply:	
	3.3 kV ±6%,50 Hz	Voltage for motors equal to / bigger than 200 KW and for power distribution within the plant.
	415 V ±10%, 50Hz	Standard voltage for power supplies to small electric power consumers and motors above 0.2 KW upto 200 KW
	Bidder shall design and supply the equipment suitable for satisfactory operation under above mentioned power supply condition.	

5.1 SLURRY ANALYSIS

S.No	Constituents	Parameters
1.	Slurry to be handled	Gypsum Slurry
2.	Chloride Content	<24350 ppm
3.	Specific Gravity at pump section	1.213
4.	Vapor Pressure at Pump	0.212 Kg/cm ²
5.	Viscosity at Pump	0.01 Pa.S
6.	Concentration of Solid	30% wt.
7.	SiO ₂ Content	4 to 6 g/l
8.	pH	4-8
9.	Slurry Temperature (Design)	70 deg.C (Max)

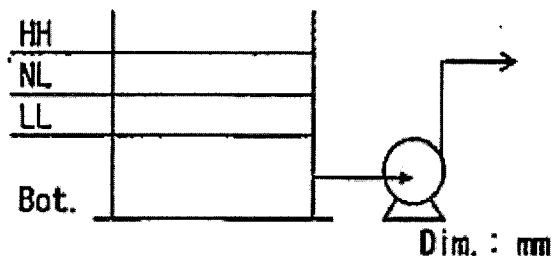


TECHNICAL SPECIFICATION OF RECIRCULATION PUMP BARH-II (2X660 MW)

BARH-II:FGD:ARP:R00

5.2 ABSORBER TANK LEVEL

HH	Bottom +	6,000	
NL	Bottom +	5000	@ NPSH Base
LL	Bottom +	4,200	



S.No	NPSH Calculation Results	SI Unit	Value
1	NPSH available @bottom w.r.t. NL of 5m	m	11.46

5.3 WATER ANALYSIS

The following water to be used for flushing of the Recirculation pump.

S.No	Constituents	Unit	Water quality
1.	Total Cations as CaCO_3	ppm	2136.75
2.	Total Anions as CaCO_3	ppm	2136.75
3.	Calcium as CaCO_3	ppm	1102.75
4.	Magnesium as CaCO_3	ppm	506
5.	Sodium as CaCO_3	ppm	528
6.	Potassium as CaCO_3	ppm	
7.	Iron as Fe	ppm	1.65
8.	Total Alkalinity as CaCO_3	ppm	1232
9.	Chlorides as CaCO_3	ppm	583
10.	Sulphate as CaCO_3	ppm	321.75
11.	Silica	ppm	55
12.	pH		7 – 8.5
13.	Turbidity	NTU	55

5.4 OPERATION & PUMP PERFORMANCE

a) Operating Description:

Operating Description of the pumps is as follows. Pumps shall cover this entire operation mode



TECHNICAL SPECIFICATION OF RECIRCULATION PUMP BARH-II (2X660 MW)

BARH-II:FGD:ARP:R00

1. No of Boilers-2 No's
2. Five (05) pumps (4 working + 1 standby) are connected to the common header of the recirculation line per boiler
3. Operating modes of this pumps are:
 - (1) Sequential startup of the pumps one by one
 - (2) i) Three (03) Pumps in continuous operation per boiler
ii) Four (04) Pumps in continuous operation per boiler
 - (3) Sequential shut down of the pumps one by one
 - (4) Emergency shutdown of maximum four (04) pumps per boiler at the same time in case of power failure. In this case the discharge valve of the pumps will be fully closed within 15 sec. Pump shall endure reverse flow.

b) Pump Performance (Important): The following are the requirement on the pump performance

- (1) The capacity of the pump (design Condition) shall be 11750 m³/hr. at the pump head of 17.9 meter Height.
- (2) The shaft power at the design conditions specified in (1) shall be kept as minimum as possible (overall pump efficiency shall not be less than 87%) and this shaft power shall be guaranteed by the vendor.

6.0 SCOPE OF SUPPLY

Scope for the bidders shall include Design, 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, handing over to customer

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

Sl. No	Scope
1.	Recirculation pump complete with
	i. Casing
	ii. Rotor and Shaft assembly
	iii. Gear box Coupling arrangement
	iv. Common base frame and shock pads
	v. Single Mechanical seal with automatic flushing with a connection for additional manual flushing.
	vi. Flushing and drain system



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BARH-II (2X660 MW)**

BARH-II:FGD:ARP:R00

Sl. No	Scope
	vii. Coupling guards
	viii. Expansion joints at Inlet and Discharge with limiting bolt & nuts.
	ix. Companion flanges with gaskets and fasteners
	x. Casing drain terminated at battery limit with flange as applicable
	xi. Bearing cooling as applicable
	xii. Lubrication system as applicable
	xiii. Foundation bolts for supplied items
	xiv. Mechanical Running and Performance test at shop
	xv. Instrument like PG, bearing temp sensor, as per requirements
	xvi. Painting and Rust Prevention during shipment and construction
	xvii. Supervision of Erection & commissioning at site
	xviii. Special tools & tackles as applicable
	xix. Erection and start-up spares like temporary strainers at pump suction pre-commissioning
	xx. Installation, operation and maintenance manuals
	xxi. Mandatory spares
	xxii. Any other items required for completeness of the equipment except the items covered in the exclusions.

6.1	TECHNICAL REQUIREMENTS
1.	All recirculation pumps shall be identical and interchangeable.
2.	The pumps shall be designed for continuous operation. The pump shall be single stage centrifugal type capable of delivering the rated flow at rated head as specified in the respective clauses. The slurry concentration in the pump shall not exceed 30% by weight.
3.	The Absorber Recirculation Pumps shall circulate the scrubbing liquid from the absorber sump to the spray nozzles in the absorber. The pumps shall be designed as impeller centrifugal (non-clog centrifugal) pump.
4.	The Pumps shall be wear resistant be equipped with flushing devices to prevent sedimentation and shall be designed and installed in a manner to allow easy replacements, repair and maintenance.
5.	The recirculation pumps shall be equipped with oil level indication, coupling guard and collecting equipment for leakage, made of resistant material.
6.	Single mechanical seals with automatic flushing with a connection for additional manual flushing shall be applied.
7.	Pump shall be driven by the motor with gearbox. A service factor of 1.5 or better should be constituent of Gear Box.
8.	All the pump wear parts in contact with the slurry shall be provided with replaceable rubber/elastomer liners suitable for the fluid handled. The Bidder can also offer a Hi-chrome alloy lined pump if the bidder has previous experience of the same for similar applications. The material used by the contractor shall be proven in previous installations. A Silicon Carbide Impeller and SiC lining for casing can also be accepted if the manufacturer has supplied a similar pump for a previous installation of a similar service.



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BARH-II (2X660 MW)**

BARH-II:FGD:ARP:R00

9.	The design of the shaft shall ensure that the operating speed is at least 20% above the critical speed of the shaft.											
10.	The pump shall be provided with seals of proven type and shall be designed for minimization of seal water consumption. The shaft shall be supported on heavy-duty ball/roller bearings.											
11.	All pumps shall be designed to withstand a test pressure of 1.5 times the maximum possible pump shut off pressure under maximum suction pressure conditions											
12.	Product water flushing lines and drains are to be supplied for each pump handling the prevailing water to avoid corrosion if the pump is out of operation for extended periods.											
13.	Pumps must be carefully set to ensure that the net positive suction head available under all operating conditions will be adequate. The NPSH Values are to be referred to the least favorable operating conditions- lowest atmospheric pressure, lowest level of water on the suction side of the pump and highest temperature of the pumped fluid. An adequate safety margin of normally greater than 1m to the max NPSH required shall be provided.											
14.	The Pump shall be capable of developing the required total head at rated capacity for continuous operation. Also the pumps shall be capable of being operated to give satisfactory performance at any point on the HQ characteristics curve. The operating range of the pump shall be 40% to 120% of the duty point unless otherwise mentioned elsewhere. The maximum efficiency of pump shall preferably be within $\pm 10\%$ of the rated design flow as indicated in data sheets. The total head capacity curve shall be continuously rising from the operating point towards shut-off without any zone of instability and with a minimum shut-off head of about 15% more than the design head.											
15.	<table><tr><th>Speed</th><th>Antifriction Bearing</th><th>Sleeve Bearing</th></tr><tr><td>1500 rpm and below</td><td>75.0 micron</td><td>75.0 micron</td></tr><tr><td>3000 rpm</td><td>50.0 micron</td><td>65.0 micron</td></tr></table> The noise level shall not exceed 85 dBA overall sound pressure level reference 0.0002 microbar (the standard pressure reference for air sound measurement) at a distance of 1 M from the equipment surface			Speed	Antifriction Bearing	Sleeve Bearing	1500 rpm and below	75.0 micron	75.0 micron	3000 rpm	50.0 micron	65.0 micron
Speed	Antifriction Bearing	Sleeve Bearing										
1500 rpm and below	75.0 micron	75.0 micron										
3000 rpm	50.0 micron	65.0 micron										
16.	The pumps shall be capable of starting with discharge valve fully open and close condition. Motors shall be selected to suit to the above requirements. Continuous Motor rating (at 50 deg.C ambient) shall be atleast ten percent (10%) above the maximum load demand of the pump in the entire operating range to take care of the system frequency variation and no case less than the maximum power requirement at any condition of the entire characteristic curve of the pump											
17.	Venting valve shall be fitted to all pumps at suitable points on the pump casing unless the pump is self-venting due to the arrangement of the suction and discharge nozzles. Drainage facilities shall be provided on the pump casing or adjacent pipe work to facilitate the dismantling of pumps.											
18.	Design pumps not to be damaged during reverse rotation at up to 150% of design RPM, at full discharge head in the event that a pump trips while the other operating pump remain on line.											
19.	Pumps shall have stable head-capacity characteristics curve from run-off to shut-off. Shut-off head should be minimum 125% of Best Efficiency Point (BEP).											
20.	Selection of Duty point should preferably be at BEP (Best Efficiency Point) or slightly at the left of BEP. Selection point beyond 115% of BEP will not be acceptable. It should be noted that head											



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BARH-II (2X660 MW)**

BARH-II:FGD:ARP:R00

	variation is due to level variation in tank. Pump has to run in the system without compromising its NPSH requirement at lowest water level in tank. Hence, when tanks are filled-up and is at normal water level, pump will operate at the right of BEP, pump's operating zone should be considered accordingly.
21.	The Pump should achieve a minimum efficiency of 87 % at duty point (11,750 m ³ /hr. @ 17.9 mH).
22.	A factor of 1.2 for "Froth" should be taken into account for sizing the pump. If Bidder, from their own experience, specifies that froth factor should not be taken into account or a different factor to be taken into account for FGD pump, the same should be clearly specified. Suction size of the pump should be adequate to take this extra capacity and the same should be reflected in master curve suction specific speed of pump should not exceed $N_s=160$ (metric), taking into account the "Froth factor".
23.	External flushing is required to remove the accumulated particles and all related information should be mentioned in data sheet.
24.	Pump should have adjustment provision of axial clearance between casing and impeller for maintenance of performance at best efficiency when there is wear in between impeller and casing.
25.	In case rubber or nonmetallic linings are used, these will be two piece molded under pressure and adjusted to the screwed metallic clamping which have been welded to the casting.
26.	Each pump will have a coupling of adequate size, designed for full load and capable of supporting start -Up an overload moment. Each half of the coupling will be factory mounted and locked to its shaft. The coupling must be able to accept the adjustment of the impeller.
27.	The Antifriction bearing of the pumps shall be designed for minimum useful life (L-10) of 20,000 hours of continuous operation (Under the design condition). The thrust bearing will have dimensions for a minimum of 175 % of the required load.
28.	The pumps shall have mechanical seals of cartridge type with self-lubrication sliding ring cartridges. The static part will be mounted on the seal plate with circumferential ring (O-ring) or another flexible sealing ring. Built in seal design will not be accepted.
29.	The sealing areas shall be designed in such a way so that solids do not precipitate in them affect the cooling or affect the adjustment and mechanical functioning of the seals. Seals which do not need jet cleaning are preferred.
30.	Pump induced vibration due to flow pulsations shall be avoided through suitable design.
31.	Each rotating equipment shall be first statically balanced and then dynamically balanced according to ISO 1940 (in the case of impellers this shall be done before and after mounting of the service rotor shaft).
32.	Make of Bearings: SKF /FAG only.



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BARH-II (2X660 MW)**

BARH-II:FGD:ARP:R00

6.2	CONSTRUCTIONAL FEATURES
A)	CASING
a.	The pump casing shall preferably be radially split for ease of maintenance and be designed such that the impeller and shaft are capable of being withdrawn from the casing without disturbing any of the main pipework and valves carrying the pumped fluid. In general, all horizontal pumps with draw-out-rotors are to be fitted with a coupling to facilitate disassembly without removing the motor.
b.	The casing and flanges shall be designed to withstand the maximum shut-off pressure developed by the pump at the pumping temperature.
c.	Pressure casing shall be designed with a corrosion allowance to meet the requirement "Technical requirements" and taking into account the "Operating Parameters".
d.	Connection for suction and discharge pressure gauge shall be provided as standard feature.
e.	Lifting provision of pump as a whole and individual casing, half should be provided.
f.	For all pumps, the casing material shall be Carbon steel / C.I with rubber lining or Silicon carbide or, hi chrome alloy line. The material used by the contractor shall be proven in previous installations.
g.	For replaceable rubber liner, hardness of rubber should be of Shore hardness- SA 65 (+/-) 5. Rubber should be of Type and Class as defined by ASTM D-2000, which is suitable for uninterrupted operation of 5 years (minimum).
h.	Pump casing shall be provided with a vent connection and piping with valves and fittings. Casing drain as required shall be provided complete with drain valves.
i.	All the wear parts of the pump shall be guaranteed for a minimum wear life of not less than 14000 hrs.
j.	Renewable wear rings shall be provided at points of running clearance and shall be made from appropriate materials.
B)	IMPELLER
a.	Impeller material shall be either Hi Chrome or a Silicon Carbide impeller, guided by operating parameters taking into account the corrosion and erosion effect as per slurry parameters.
b.	Miller number for the material should be justified for that pumping medium as per ASTM G75-95 as well as the corrosion effect of pumping medium.
c.	Base material for rubber-lined impeller should be capable of handling speed as specified in the respective clause without affecting adhesion of lining. Impeller as rotating assembly along with all elements should be dynamically balanced according to ISO 1940



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BARH-II (2X660 MW)**

BARH-II:FGD:ARP:R00

d.	Impeller tip speed shall be within vendor's experience. And Impeller shall have air bleed holes to eliminate any air accumulation around the shaft seal
e.	Maximum size impellers for the pump body shall not be quoted for. By installation of a new impeller a head increase of 5% minimum shall be possible.
C)	SEALS:
a.	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. The sealing faces should be highly lapped surfaces of materials known for their low frictional coefficient and resistance to corrosion against the liquid being pumped.
b.	Design the mechanical seals chamber to have sufficient room to lubricate and get seal face cool with its own slurry.
c.	Provide requirements for periodical flushing to rinse the seal face for leaked slurry.
d.	Pump shall be supplied with mechanical seal. All mechanical seals, regardless of type or arrangement, shall be of the cartridge design. Hook sleeve cartridge should not be used.
e.	Requirement of flushing water, its quantity, and pressure to be indicated in data sheet.
f.	Zero leakage is the intension of this specification. However, quantity of leakage, if it is unavoidable, pump should have a provision of collecting of any drip leakage and flushing the same to nearby pit is to be providing without corroding the base plate of pump.
g.	Mechanical seals shall be fitted and installed in the pump before shipment and shall be clean. Mechanical seals shall be plugged with screw for shipping
h.	Intention of the specification is not to specify Type of Seal, Seal design, Spring configuration, Seal configuration, Balanced or Unbalance type etc. The pump supplier shall coordinate with the seal maker in establishing the seal chamber of circulation rate for maintaining a stable film at the seal face. The seal piping system shall form an integral part of the pump assembly. For the seals under vacuum service, the seal design must ensure sealing against atmospheric pressure even when the pumps are not operating. Necessary provision for seal water supply along with complete piping fittings and valves as required shall form integral part of pump supply
i.	Seal life has to be guaranteed, taking into consideration all its components for 20000 hrs. If the seals fail before the completion of guaranteed period, the same should be replaced free of cost by the bidder.
j.	Make of Mechanical Seals: Eagle Burgmann/ Flowserve/ John crane only. No other make is acceptable
D)	SHAFT AND SHAFT SLEEVE
a.	All Pump shafts shall be of ample size to transmit the maximum possible output from the prime mover.
b.	The pump shaft and coupling are to be so dimensioned that the maximum permissible torque of the shaft is higher than the maximum transmissible torque of the coupling and gear. Pumps with Gearbox are required.

	TECHNICAL SPECIFICATION OF RECIRCULATION PUMP BARH-II (2X660 MW)
BARH-II:FGD:ARP:R00	

c.	Pumps shall operate smoothly throughout the speed range up to their operating speeds. The critical speed shall be well away from the operating speed and in no case less than 130% of the rated speed. The determination of the shaft diameter and the distance between two consecutive bearings must include a sufficiently large safety margin to satisfy this condition.
d.	Shafts shall be conservatively designed to transmit maximum power required and to assure rigidity. The shaft shall be ground and polished to final dimensions and shall be adequately sized to withstand all stresses from rotor weight, hydraulic loads, vibration and torques coming in during operation.
e.	Shaft shall run in high precision heavy duty roller bearings. Lubrication system provided shall be such that visual checking of lubricant level is possible
f.	The shaft shall be finished to close tolerance at the rotor, coupling and bearing diameters. The size of shaft shall be calculated on the basis of maximum combined shear stress. This shear stress shall not exceed 30 percent of the elastic limit in tension or 18 percent of ultimate tensile strength.
g.	No parts of the shaft should come in contact with the liquid medium.
h.	Renewable type fine finished shaft sleeves shall be provided at the stuffing boxes/mechanical seals. Length of the shaft sleeves must extend beyond the outer faces of gland packing of seal end plates so as to distinguish between the leakage between shaft and shaft sleeve and that past the seals/gland. Shaft sleeves shall be fastened to the shaft to prevent any leakage or loosening. Shaft and shaft sleeve assembly should ensure concentric rotation. Shaft sleeve should be CD4M Cu ASTM A-743 or equivalent. Sleeve should have this as a guaranteed value/parameter to prevent wear and corrosion of mating surface. Manufacture to indicate the diameter in data sheet.
i.	Shaft should have a keyed joint or thread connection between impeller and shaft.
E) COUPLING	
a.	The HT drive motor is excluded from the scope of supply. However, the bidder shall supply coupling and gearbox for secondary transmission.
b.	Coupling halves shall be machine matched to ensure accurate alignment. Couplings and gears must have a rated capacity of at least 120% of the maximum potential power transmission requirement.
c.	Coupling shall be of flexible type made of cast steel. The Bidder shall furnish both halves of the coupling. Both the Coupling halves shall be bored and keyed to fit shafts of the gearbox and the motor by bidder.
d.	All rotating parts such as coupling shall be covered with suitable protective guards. Guards shall be easily removable type. If weight of the coupling is heavy (>40 kgs), provision of tapped hole should be incorporated in right place of hub to handle the same effortlessly



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BARH-II (2X660 MW)**

BARH-II:FGD:ARP:R00

F)	BASE PLATE
a.	A common base plate shall be provided for pump assembly & Motor and the same shall be rigidly constructed, adequately braced and provided with finish pads for mounting pump.
b.	Suitable holes shall be provided for grouting and these shall be so located that the base plate can be grouted in place without disturbing the pump and motor.
c.	Common base plate for pump and Motor shall be in the scope of the bidder and the details of the Motor will be furnished to the bidder to provide Motor mounting bolts.
d.	Base plate must have provision of aligning driver and driven shaft in both directions of base plate so that shafts can be aligned. Similarly, provision must be provided for alignment of shaft in vertical plane.
e.	Pump manufacturer is to supply base plate along with Foundation bolt & Nut, "Taper wedge" and the necessary fastener for Pump and Motor with Base plate. Even if Motor is excluded from their scope, necessary fastener for motor foot with base plate will remain in pump scope of supply in order to avoid any problem.
f.	Base plate must be provided with a trough, material of which must be compatible of pumping liquid. Leaked liquid, collected in trough, can be systematically routed at designated point
g.	Base plate must be stress-relieved for any residual welding stress and certificate to that effect is to be submitted as per inspection requirement.
h.	Base frame shall be epoxy coated with proper finishing.
G)	BEARINGS
a.	The bearings may be ball, roller or sleeve bearing. If sleeve bearings are used these shall be machined for close running fit. The bearings shall be designed to take the necessary radial load as well as the net axial thrust. Bearings shall be lubricated properly and sized for an operating life of 20,000 hours on the basis of maximum load. Oil level indication shall be provided.
b.	The bearings shall be of automatic oil lubricated type. Bearing temperature element with temperature transmitter shall be provided.
c.	Bearing housings on horizontal shaft pumps shall be designed to enable the bearings to be replaced without removing the pump or motor from its mounting. Bearing housings on horizontal shaft pumps shall be effectively protected against the ingress of water, pumped fluid and dust by suitable nonferrous deflectors.
d.	If Cooling water for gearbox cooling is required, volume and pressure of cooling water is to be indicated in Technical Data Sheet. The following details has to be provided 1. Inlet temp: 38°C 2. Max allow temp increase: 5°C 3. Pressure Drop : < 1 Bar

	TECHNICAL SPECIFICATION OF RECIRCULATION PUMP BARH-II (2X660 MW)
BARH-II:FGD:ARP:R00	

e.	Bearing temperature sensor shall be provided for local monitoring of the bearing metal temperature of pump. Bearing temperature sensor shall provide signals to FGD DCS for continuous monitoring.		
f.	Lubricating oil will be the responsibility of pump 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.		
H) ACCESSORIES:			
1. Expansion Joints:			
i.	Expansion Bellows(with Tie Rod Arrangement) with limiting bolt & nut shall be provided at suction and discharge of each pump .		
2. Pump control:			
i.	Each pump shall be furnished with required instrumentation and electrical accessory devices mounted and connected in a control cabinet.		
ii.	Provisions shall be made for the interface between the local cabinet and the DCS such that the operation of the pumps can be controlled from the control console in the FGD Control room		
iii.	Provision for vibration sensor, key phase sensor shall be provided. These shall be provided for X axis & Y axis vibration measurement in bearing housing. Provision shall be in line AP1670, 15th edition & provision shall be covered suitably.		
iv.	Alarm Signal: Bearing temperature sensor for alarm during when "Bearing Temperature high" shall be supplied by Bidder. The following instruments have to be provided for each pump:		
	S.No.	Description	Min Qty / pump
	1	Pump Bearing TE RTD PT100 DUPLEX	6 nos. (3 nos. at drive end & 3nos. at non drive end)

7.0 GENERAL REQUIREMENTS:

S.No	Description
1.	Metric unit shall be used in the drawings and in the any displays on the equipments. Special attention should be taken that the unit of pressure shall be in dual scales of kPa and kg/cm ² G.



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BARH-II (2X660 MW)**

BARH-II:FGD:ARP:R00

S.No	Description
	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. Predicted sound pressure levels for the pump drive assemblies shall be submitted as part of the proposal data.
6.	The overall vibration level shall be as per ISO 10816.
7.	Suitable drain connections shall be provided.
8.	The equipment shall be suitable for stable operation continuously.
9.	Limit of connection: The buyer (BHEL) has an intention to minimize interface for utilities as much as possible. The bidder shall consider this requirement in the planning stage of layout for the equipment. The bidder shall provide the header piping for utilities and branch piping to each nozzle. Terminal points for all utilities shall be located at skid edge. The bidder shall specify all terminal points with tie-in number in the P&ID and submit it in the proposal to confirm the scope of supply.
10.	Service life: Entire equipment except wearing parts shall be designed and fabricated for a minimum service life of 30 years of operation or 200,000 full load operating hours whichever is longer.
11.	Corrosion allowance: Corrosion allowance for entire equipment shall be in accordance with latest applicable Indian / International standard.
12.	Unless otherwise specified , flanges shall be in accordance with ANSI B16.5 Class 150, ASME B 16.47
13.	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.
14.	Rotation arrows shall be cast in or attached with stainless steel plate on each item of rotation equipment at a readily visible location.
15.	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

	TECHNICAL SPECIFICATION OF RECIRCULATION PUMP BARH-II (2X660 MW)
BARH-II:FGD:ARP:R00	

S.No	Description
	lugs. When any spreader bars are required for lifting and laydown, the bidder shall provide spreader bar with equipment.
16.	Skid Mount/Transportation: Equipment shall be fabricated as skid mount design as much as practical to minimize erection at the site.
17.	Two pieces of stainless steel earth lugs shall be provided with equipment diagonally. The position of earth lugs shall be shown on each GA and/or outline drawing.
18.	Provide double nuts for anchor bolts
19.	Bidder shall provide allowable vibration level on foundation in foundation drawings and/or general arrangement drawings.
20.	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.
21.	Bidder shall provide the mating flanges with the necessary gaskets.
22.	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.
23.	Bidder to provide capacity of crane or hoist required for material handling and the details of heaviest component to be handled.
24.	The list of all Bought out items with makes and country of origin to be mentioned along with offer to be submitted
25.	Quality Plan to be submitted along with the offer.
26.	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.
27.	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.
28.	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.
29.	It shall be the complete responsibility of the successful bidders to obtain "Sub Vendor Approval" from BHEL / NTPC for all equipments & components. Any delay in sub vendor's approval should not affect the project schedule. If any of the sub vendors does not have the



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BARH-II (2X660 MW)**

BARH-II:FGD:ARP:R00

S.No	Description
	approval of NTPC/ BHEL, the same may be replaced with another NTPC/BHEL approved sub-vendor only, without any price implications to BHEL.
30.	The modalities of inspection (Stage, Final, In-process) shall be finalized during detail engineering after submission of quality assurance plan (QAP). It shall be reviewed by the NTPC/ BHEL. Bidder shall follow the procedures of inspection as per the approved QAP. Bidder has to submit the following documents along with inspection call and if any other documents required as per approved QAP. - Raw material inspection certificate - Internal test reports - Statutory certificates as required. - All inspection & testing shall be carried out based on the following documents: a. Relevant Standards b. Specifications c. Approved drawings d. Data Sheets e. Calibration certificate for all the measuring instruments f. Bidder should also coordinate in getting the MDCC's (Material Dispatch clearance certificate) and all types of IC's (Inspection Certificates) from the NTPC along with BHEL.
31.	Minor Chipping i.e. up to 50 mm thk, micro leveling and providing shim plates for erection of equipment / item at site shall be in the scope of bidder.
32.	During detail engineering, bidder to strictly adhere to BHEL/NTPC drawing formats, document numbering, quality plan & FQP formats
33.	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.
34.	Complete detail engineering drawings, calculations, selection of components etc. shall be reviewed & subject to approval of BHEL/NTPC during detail engineering
35.	Bidder shall furnish necessary inputs & drawings of all equipment in editable Auto CAD/ MS-Word /Excel format.
36.	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.
37.	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.
38.	Bidder shall submit the signed and stamped copy of all the pages which constitutes this

	TECHNICAL SPECIFICATION OF RECIRCULATION PUMP BARH-II (2X660 MW)
BARH-II:FGD:ARP:R00	

S.No	Description
	technical enquiry specification signed by authorized signatory and clearly mentioning each clause under following two categories to avoid any ambiguity in scope understanding & the scope division along with technical offer. a. "Accepted without deviation and considered in scope of work" b. "Not considered in scope of work"
8.0	PACKING AND FORWARDING
1.	Proper packing to be ensured. Indigenous Supply: Pump & sub system assembly shall be wrapped in polythene bags & packed in a strong rigid wooden crate. Rain water should not enter into the pump internals during storage in the outer yard of power plant. Imported Supply: All imported supply should be packed as per Sea worthy packing standards Annexure - VI. All imported items should have Sea worthy packing. Liberal packing materials and struts shall be provided to arrest rolling and to protect from transit damages.
2.	Equipment and process materials shall be packed and semi-knocked down, to the extent possible, to facilitate handling and storage and to protect bearings and other machine surfaces from oxidation. Each container, box, crate or bundle shall be reinforced with steel strapping in such a manner that breaking of one strap will not cause complete failure of packaging. The packing shall be of best standard to withstand rough handling and to provide suitable protection from tropical weather while in transit and while awaiting erection at the site.
3.	Equipment and materials in wooden cases or crates shall be properly cushioned to withstand the abuse of handling, transportation and storage. Packing shall include preservatives suitable to tropical conditions. All machine surfaces and bearings shall be coated with oxidation preventive compounds. All parts subject to damage when in contact with water shall be coated with suitable grease and wrapped in heavy asphalt or tar impregnated paper.
4.	Crates and packing material used for shipping will become the property of owner.(NTPC)
5.	Packaging or shipping units shall be designed within the limitations of the unloading facilities of the receiving ports and the ship will be used. It shall be the bidder's responsibility to investigate these limitations and to provide suitable packaging and shipping to permit transportation to site.
6.	Packing (tare) shall be part of the equipment cost and shall not be subject to return. The packing should ensure integrity and cohesiveness of each delivery batch of equipment during transportation. In case of equipment assemblies and unit's delivery in the packing of glass, plastics or paper the specification of packing with the material and weight characteristics are to be indicated.
7.	Each package should have the following inscriptions and signs stenciled with an indelible ink legibly and clearly:



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BARH-II (2X660 MW)**

BARH-II:FGD:ARP:R00

S.No	Description
	a. Destination b. Package Number c. Gross and Net Weight d. Dimensions e. Lifting places f. Handling marks and the following delivery marking
8.	Each package or shipping units shall be clearly marked or stenciled on at least two sides as follows. BHEL SITE OFFICE BARH-II- 2x660 MW, NATIONAL THERMAL POWER CORPORATION BIHAR,PATNA, INDIA EPC CONTRACTOR: BHARAT HEAVY ELECTRICALS LIMITED, INDIA" In addition, each package or shipping unit shall have the symbol painted in red on at least two sides of the package, covering one fourth of the area of the side.
	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.
9.	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.
10.	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.
11.	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)
12.	Marking for Safe handling: To ensure safe handling, packing case shall be marked to show the following: a. Upright position b. Sling position and center of Gravity position c. Storage category d. Fragile components (to be marked properly with a clear warning for safe handling)

	TECHNICAL SPECIFICATION OF RECIRCULATION PUMP BARH-II (2X660 MW)
BARH-II:FGD:ARP:R00	

S.No	Description
13.	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.
14.	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 pump & accessories, BHEL item Code, Gross Weight and Net weight of Supplied items.
15.	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.
16.	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.
17.	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.
18.	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).
19.	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.
9.0	SUPERVISION OF ERECTION, TESTING AND COMMISSIONING
1.	The erection of Recirculation Pumps will be done by owner as per Erection Manual and check List. However, the bidder shall make one visit per boiler for the supervision of erection, pre-commissioning & post- commissioning check-up, start-up, testing and trial runs of all the items covered under the scope of supply.
2.	There will be one visit per boiler and totally there will be 2 visits for 2 boilers. The bidder will be informed well in advance for the visit. Bidder shall include 15 working days per visit in the offer with minimum 2 visits.



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BARH-II (2X660 MW)**

BARH-II:FGD:ARP:R00

S.No	Description
3.	TA/DA, boarding and lodging shall be borne by the bidder and shall be inclusive in supervision portion.
10.0	EXCLUSION
	The following work associated with the recirculation pump are excluded from bidder's scope: a. Supply of main drive HT motor b. Civil foundations c. Walkways, platforms and ladders d. Equipment/item handling hoists
11.0	INSPECTION AND TESTING
A)	Minimum Testing requirements to be considered are as below:
1.	Hydrostatic test is to be conducted at 150 % of design pressure for duration of 30 minutes, taking into consideration of the fact that actual operating temperature is 60 deg Celsius (maximum).
2.	Impeller and rotor shall be first statically balanced and then dynamically balanced according to ISO 1940 (in the case of impellers this shall be done before and after mounting of the service rotor shaft).
3.	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.
4.	List of Non-Destructive test over and above the material test are as follows: a. Casing: Material test, Magnetic particle (MPI), DP and Hydro test as applicable. b. Impeller- DPT and MPI as applicable. c. Shaft- Ultrasonic (UT), DPT and MPI. d. Sleeve- DP and Hardness test / Manufacturer's recommendation. e. Mechanical Seal- Manufacturer's recommendation. f. Base Plate- Stress relieving of weld. g. Replaceable Rubber liner- Shore Hardness, Class and Type certificate
5.	Once mounting is finished and operation less will be conducted on each pump to determine the characteristic curves. For dynamic pressure and volume output, and to determine the parameters at the design point, mechanical running & performance testing shall be performed & witnessed.
6.	NPSH Test, Vibration test and Noise level test shall be witnessed at shop.



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BARH-II (2X660 MW)**

BARH-II:FGD:ARP:R00

S.No	Description
7.	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.
8.	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.
9.	Test certificates shall be issued for each lot of raw material used in the coating, corresponding to specific weight and traction resistance.
10.	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.
11.	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.
B)	General Inspection requirements to be considered are as below:
1.	Bidder shall furnish written copies of shop production, fabrication and quality test procedures and drawings to be used for review by BHEL / NTPC prior to manufacture. Inspection of above mentioned tests by BHEL/ NTPC representative at bidder's works is envisaged.
2.	The Bidder shall furnish performance test procedure along with standard. The test procedure will be reviewed and approved by the BHEL/NTPC.
3.	Out of 8 Recirculation Pumps, One Number of Recirculation Pump will be inspected at the Bidder's works before dispatch or where the test facilities are available. However, if NTPC insists for performance testing of all the pumps the same shall be carried out at no additional cost.
4.	The Bidder shall conduct performance test for the remaining pumps and submit the reports.
5.	A dynamic balancing certificates stating that the rotating assembly has been balanced dynamically shall be sent to NTPC/ BHEL within one (1) week of the successful completion of balancing.
6.	Acceptance tolerance of actual versus guaranteed performance for capacity, head, efficiency and power absorbed shall be as per applicable standard.
7.	Vibration levels shall be measured during shop running/performance tests.
8.	Contract shaft seals shall be used during shop tests, unless the seal design is unsuitable for the shop-test condition.
9.	Recirculation pumps shall not be released for shipment, until shop tests data and performance tests curves have been approved by Owner.



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BARH-II (2X660 MW)**

BARH-II:FGD:ARP:R00

S.No	Description
10.	Bidder should furnish performance guarantee as per applicable standard guarantee for the design, manufacture, material and safe operation of the equipments.
11.	BHEL shall witness the test at Bidder's works and a notice of minimum three (3) weeks shall be given for attending the inspection.
12.	Bidder to arrange all calibrated gauges, Instruments during inspection.
13.	Mechanical running and the performance test shall be carried out. Bidder to arrange Motor of same / higher rating for the shop test and inspection.
14.	The performance test may be carried out using water at shop and shall be converted to the design condition.
15.	Inspection and testing will be done as per NTPC approved Quality Plan. In case of order placed on foreign Vendor(i.e supplies from outside India), Vendor shall engage and appoint at their cost of any reputed Third Party Inspection Agencies having international presence for carrying out inspection of equipment's and material at vendor's & sub vendors works.
12.0	PAINTING
1.	Surface Preparation : Power Tool Cleaning to St3 (SSPC- SP3)
2.	PRIMER COAT: Primer: Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats) - 60 μ
3.	Intermediate: One coat of Synthetic Enamel intermediate coat to IS 2932; DFT- 50 μ
4.	FINISH COAT: Two coats of Synthetic Enamel to IS 2932, DFT- 50 μ / coat Shade will be informed later Total DFT= 210 μ
5.	COLOUR CODE (based on DIN 2403:2007-05 & DIN 5381) a. Base: To be informed later



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BARH-II (2X660 MW)**

BARH-II:FGD:ARP:R00

S.No	Description
	b. Lettering: To be informed later.
6.	Rust preventive paint after inspection at shop floor before dispatch shall be in bidder's scope
7.	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.
13.0	SPARES, TOOLS & TACKLES
13.1	START UP & COMMISSIONING SPARES
	Start-up & Commissioning Spares shall be part of the main supply of the Recirculation pumps. 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 pump 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 equipments are energized. Supply of temporary strainers for pre-commissioning is mandatory.
13.2	FINAL SPARE PARTS LIST (RECOMMENDED SPARES)
	Bidders shall also furnish the Final Spares Part List (i.e. 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.
13.3	MANDATORY SPARES
	Bidder to quote for below mentioned mandatory spares with break up price: 1. Impeller Assembly - 4 nos. 2. Complete casing- 1 nos. 3. Casing liners (where replaceable liners are provided) – 1 set 4. Seals - 4 sets of each type and size 5. Bearings -1 nos. of each type and size 6. Gearbox- 1 No 7. Motor-Pump Coupling – 1 No Bidder shall quote for the above "Mandatory Spares", and it will be considered for L1 evaluation. Mandatory spare 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 equipments. 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 Mandatory spares shall be manufactured



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BARH-II (2X660 MW)**

BARH-II:FGD:ARP:R00

S.No	Description
	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.
13.4	SPECIAL TOOLS & TACKLES:
	Any special tools & tackles required for the entire equipment to disassemble, assemble or maintain the units, they shall be included in the quotation and furnished as part of the initial supply of the machine. List of special tools & tackles shall be decided by bidder as per his proven practice. When special tools are provided, they shall be packaged in separate, boxes with lugs and marked as "Special Tools for (tag / item number)." Each tool shall be stamped or tagged to indicate its intended usage. Levers and eye bolts for the removal of parts to be serviced shall be submitted with special tools.
14.0	PERFORMANCE GUARANTEE
	All performance tests for Recirculation pumps shall be carried out in accordance with any latest international codes/standards. 1) Bidder shall furnish Performance guarantee for the design, manufacture, material, safe and trouble-free operation of the Recirculation pump and its accessories 2) Capacity and head of the pump to be guaranteed. 3) The Contractor shall guarantee 98 % availability of equipment for a continuous period of 120 days. 4) All the wear parts of the pump shall be guaranteed for a minimum wear life of not less than 14000 hrs. 5) Noise level-≤ 85 dB (A) at 1m horizontal distance from equipment/enclosures and 1.5m above operating floor is to be guaranteed. 6) 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. 7) Acceptance tests to be carried out as per the procedure defined by the bidder which shall be submitted for BHEL/ NTPC approval. 8) In the event that the performance test is unsuccessful, bidder shall take necessary remedial action at his cost and the performance test shall be repeated.
15.0	WARRANTY/DEFECT LIABILITY



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BARH-II (2X660 MW)**

BARH-II:FGD:ARP:R00

S.No	Description
1.	The Bidder warrants that the equipments/items shall be free from defects in the design, engineering, materials and workmanship of the Plant and Equipment supplied and of the work executed. The Defect Liability Period shall be 24 months from the date of supply or 18 months from the date of commissioning, whichever first occurs. If during the Defect Liability Period any defect should be found in the design, engineering, materials and workmanship of the Plant and Equipment supplied or of the work executed by the Bidder, the Bidder shall promptly, in consultation and agreement with BHEL regarding appropriate remedying of the defects, and at its cost, repair, replace or otherwise make good (as the Bidder shall, at its discretion, determine) such defect as well as any damage to the Facilities caused by such defect..
2.	In case of failure of the equipment to meet the guarantee, NTPC/BHEL reserves the right to reject the equipment. However, NTPC/BHEL reserves the right to use the equipment until new equipment supplied by bidder meets the guaranteed requirement.
16.0	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 chemicals, consumables, lubricants and grease shall be readily obtainable locally and the number of different types shall be kept to a minimum. For each type and grade of lubricant recommended, bidder shall list at least three equivalent lubricants manufactured by alternative companies.
17.0	TRAINING
	Successful bidder shall provide comprehensive training for NTPC/BHEL Engineering, O&M, Erection & Commissioning staffs at site covering all aspects of the Recirculation pumps - Operation & Maintenance, Troubleshooting etc.
18.0	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



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BARH-II (2X660 MW)**

BARH-II:FGD:ARP:R00

S.No	Description
	Specification.
19.0	DOCUMENTATION
A	DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER
	The Bidder shall submit all documents, drawings, diagrams and all such information, which are necessary to fully understand the offer for techno – commercial evaluation. As a minimum requirement, the information required as per Annexure-V shall be furnished to fully describe the scope of work and services offered. The above documents are required for proper evaluation purpose and vendors are requested to comply with above in all respect.
B	DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT
	The Successful bidder shall submit necessary data, documents and drawings for review, approval with requirements specified under Annexure-V. Drawings that are reviewed by the NTPC/ BHEL will be returned to bidder with a transmittal letter with any comments and / or questions marked on the drawings or noted in the letter. All comments and questions must be resolved before a resubmission of drawings / documents. If the design has not developed enough to resolve some of the comments or questions, bidder shall place a "hold" on those items or areas of design. NTPC/ BHEL reserves the right to return drawings unprocessed to bidder if there exists any evidence that bidder has not acknowledged all comments and questions. All necessary GA drawings, sections, sub-assembly drawings, specifications of main and sub components and necessary set of operation & maintenance manual as asked by NTPC must be furnished by bidder in soft and hard copy forms. For all documents softcopy format shall be searchable pdf, however in addition all drawings, diagrams like P&IDS shall be supplied in ACAD or other editable format and all lists in Excel format. Further break up of technical documents will be discussed during finalization of the purchase contract. Unless agreed otherwise, Ten (10) hard copies and five (05) sets of electronic copies of all documents are to be submitted in the English language. Electronic Copies shall be submitted in primary original data format (e.g. DOC, XLS, DWG) as well as in a printable non-proprietary document format (e.g. PDF). Especially P&IDs shall be submitted as DWG files and PDF files. Bidder to ensure submission of hard copies as per NTPC requirement for all engineering drg/doc and for all subsequent revisions along with a soft copy through email to concerned project team. However all the engineering related information shall be furnished in soft form to BHEL.

20.0 ANNEXURES

ANNEXURE-I (PROVENNESS CRITERIA)

Bidder shall refer the document enclosed

	TECHNICAL SPECIFICATION OF RECIRCULATION PUMP BARH-II (2X660 MW)
BARH-II:FGD:ARP:R00	

ANNEXURE – II- TECHNICAL DATA SHEET

Sl. No	Description	Data
1.0	GENERAL	
	a. Client	: BHEL-Ranipet
	b. Project	: BARH-II 2x660
	c. Ultimate Customer	: NTPC
	d. Location	: Barh & patna district Bihar, India
	e. Service	: Continuous
	f. Installation	: Inside steel structure shed with roof side sheeting
	g. No of pumps for each unit	: 4 Working + 1 Standby
	h. Total number of pumps for both units	: 10 No's
2.0	MANUFACTURER DETAILS	
	a. Model	: Bidder to provide
	b. Type	: Centrifugal
	c. Type of Driver	: With Gearbox
3.0	OPERATING CONDITION	
	Medium to be handled	: Gypsum slurry
	Maximum solid particle size	: 150 mesh (140 microns)
	Normal solid particle size, d 50	: 325 mesh (43 micron) and fine particles



TECHNICAL SPECIFICATION OF RECIRCULATION PUMP BARH-II (2X660 MW)

BARH-II:FGD:ARP:R00

	Concentration of chloride	:	24,350 ppm (Max)
	Viscosity of slurry	:	10 cp
	Concentration of slurry	:	30(% by weight)
	Specific gravity of slurry	:	1.217 @ design and 1.215@ guarantee point
	pH of slurry	:	7.6-8.2
	Slurry Temperature	:	61 deg.C (normal) & 70 deg.C (max)
4.0	PERFORMANCE DATA		
	a. Capacity	m ³ /hr	: 11,750
	b. Head	M	: 17.9
	c. Pump efficiency	%	: Bidder to Provide
	d. BkW Normal / Maximum	KW	: Bidder to Provide
	e. Motor rating	KW	: Bidder to Provide
	f. Motor Speed	Rpm	: Bidder to Provide
	g. Differential pressure (inclusive of losses)	Kg/cm2	: Bidder to Provide
	h. Speed Maximum/ Normal/Minimum	rpm	: Bidder to Provide
	i. Noise level	dB(A)	: Bidder to Provide
	j. Performance curve		: Bidder to Provide
4.0	CONSTRUCTION DATA		
	a. Manufacturer		: Bidder to Provide
	b. Model No.		: Bidder to Provide
	c. Suction Rating / Size		: Bidder to Provide
	d. Discharge Rating / Size		: Bidder to Provide
	e. Type of rotor		: Bidder to Provide
	f. Size of rotor Dia	mm	: Bidder to Provide
	g. Journal bearing: Type / Size:		: Bidder to Provide
	h. Thrust bearing: Type / Size:		: Bidder to Provide
	i. Bearing cooling required		: Yes / No - Bidder to confirm
	j. Cooling water required		: Bidder to confirm the quantity
	k. Type of drive		: With Gearbox
	l. Shaft seal		: Mechanical
	m. Size / Code		: Bidder to Provide
	n. Type of coupling		: Bidder to Provide
	o. Service factor		: Bidder to Provide
	p. GD ² at drive shaft end		: Bidder to Provide
	q. Rotation viewed from coupling end		: Clock wise / Counter clock wise
	r. Coupling type		: Bidder to confirm
	s. Coupling make		: Bidder to Provide
	t. Base plate common to pump, bearing housing, coupling		: Yes / No - Bidder to confirm
	u. Total weight	kg	: Bidder to Provide
	v. Maximum Erection weight	kg	: Bidder to Provide
5.0	MATERIALS		
	a. Casing		: Bidder to Provide

	TECHNICAL SPECIFICATION OF RECIRCULATION PUMP BARH-II (2X660 MW)	
	BARH-II:FGD:ARP:R00	

	b. Impeller	:	Bidder to Provide
	c. Shaft	:	Bidder to Provide
	d. Shaft Seal	:	Bidder to Provide
	e. Base frame	:	Bidder to Provide

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----



TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BARH-II (2X660 MW)

BARH-II:FGD:ARP:R00

ANNEXURE III- SCHEDULE OF GUARANTEES

Sl. No	Description	Data
1.	Rated capacity of pump m ³ /hr.	:
2.	Total head at design capacity M	:
3.	Guaranteed shaft power consumption at rated capacity & head kW	:
4.	Noise level at a distance of 1.0 meter from the equipment at site and 1.5 m above operating floor dB(A)	:
5.	Maximum vibration (peak to peak amplitude at site) microns	:
6.	Equipment Availability (%)	:
7.	Pump Efficiency (%)	:
8.	Life of Pump wear parts including, Casing liners, bearing etc Hours	: ≥14000 hours operation

SIGNATURE OF BIDDER _____

NAME _____

DESIGNATION _____

	TECHNICAL SPECIFICATION OF RECIRCULATION PUMP BARH-II (2X660 MW)
BARH-II:FGD:ARP:R00	

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

SI No	Clause No	Page No	Description of Deviation

Note: Enlarge the table to incorporate items

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BARH-II (2X660 MW)**

BARH-II:FGD:ARP:R00

ANNEXURE -V

A) DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER:

Sl. No.	Description	No of copies With proposal
1.	Clause wise Compliance to Specification	1
2.	Un-Price Sheet	1
3.	Annexure I –Qualification documents along with Attachment 3K	1
4.	Annexure II - Data Sheet	1
5.	Annexure III- Schedule of Guarantee	
6.	Annexure IV- Deviation List	
7.	Annexure VI, Annexure VII	
8.	Performance curve(flow vs total pressure, flow vs efficiency, flow vs power consumption, Torque vs speed for motor selection)	1
9.	Approximate weight of each skid	1
10.	Anchor Plan & Civil foundation Loading details	
11.	Required Electric power & other Utility List	1
12.	General Assembly Drawing	1
13.	Pump and Motor Sizing Calculation	1
14.	Cross-sectional Drawing	1
15.	Sub-Vendor List	1
16.	Spare List (Mandatory, Recommended)	1
17.	Start-up & Commissioning Spares	1
18.	List of Special Tools	1
19.	Delivery Schedule	1
20.	Test Arrangement & Test procedure	1
21.	T-S curve	1
22.	Hoist/Crane requirement	1
23.	P & I Diagram	1
24.	Catalogue	1

B) DOCUMENTS TO BE SUBMITTED AFTER CONTRACT:



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BARH-II (2X660 MW)**

BARH-II:FGD:ARP:R00

Sl. No.	Description	No of copies After award of contract	Delivery Time
1.	Utility Consumption	1	2 weeks after contract
2.	HT Motor sizing calculation	1	2 weeks after contract
3.	Foundation Data including Anchor plan	1	2 weeks after contract
4.	Performance curve(flow vs total pressure, flow vs efficiency, flow vs power consumption, Torque vs speed for motor selection)	2	2 weeks after contract
5.	Assembly drawings of each equipment	1	1 month after contract
6.	Exploded view, Cross section detail drawing	1	1 month after contract
7.	Data Sheet	1	2 weeks after contract
8.	Lubricating oil list	1	2 months after contract
9.	Special tools list	1	2 months after contract
10.	Installation and assembly procedure	1	4 months after contract
11.	Inspection and Test Procedure	1	1 month after contract
12.	Inspection & Test record	1	In 2 weeks after test
13.	Inspection Certificate	1	In 2 weeks after test
14.	Sub vendors List	1	2 weeks after contract
15.	Manufacturing Schedule	1	2 weeks after contract
16.	Progress report	1	Every month
17.	Proforma Packing List	1	2 months prior to shipping
18.	Approximate weight of each skid	1	2 months after contract
19.	Required Electric power	2	2 weeks after contract
20.	Pump and Motor Sizing Calculation	1	2 weeks after contract
21.	Material Test Certificates	2	In 2 weeks after test
22.	Pre Commissioning Check List	2	4 months after contract
23.	Quality Plan	4	1 month after contract
24.	Operation and Maintenance Manual	• 10 hardcopies and 5 electronic copies in English	4 months after contract



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BARH-II (2X660 MW)**

BARH-II:FGD:ARP:R00

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

SIGNATURE OF BIDDER

NAME

DESIGNATION

ANNEXURE-VI

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

	TECHNICAL SPECIFICATION OF RECIRCULATION PUMP BARH-II (2X660 MW)
BARH-II:FGD:ARP:R00	

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

SIGNATURE OF BIDDER _____

NAME _____

DESIGNATION _____

ANNEXURE-VII

INSPECTION & TESTING

Refer to all clauses for Inspection & testing requirements. Sample QP enclosed



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BARH-II (2X660 MW)**

BARH-II:FGD:ARP:R00

SIGNATURE OF BIDDER _____

NAME _____

DESIGNATION _____

ANNEXURE-VIII

Instruments Specification

Refer to instruments specification enclosed.

	TECHNICAL SPECIFICATION OF RECIRCULATION PUMP BARH-II (2X660 MW)
BARH-II:FGD:ARP:R00	

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----

ANNEXURE-IX

BIDDER TO PROVIDE TEMPORARY STRAINER AT THE SUCTION SIDE OF THE PUMP. TYPICAL DRAWING IS ENCLOSED.



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BARH-II (2X660 MW)**

BARH-II:FGD:ARP:R00

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----

ANNEXURE-X

EXPANSION BELLOWS WITH LIMITING BOLT AND NUT AT SUCTION AND DISCHARGE .TYPICAL DRAWING IS ENCLOSED.



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BARH-II (2X660 MW)**

BARH-II:FGD:ARP:R00

SIGNATURE OF BIDDER _____

NAME _____

DESIGNATION _____

ANNEXURE-I AND ATTACHMENT 3k :QUALIFICATION REQUIREMENT(PROVENNESS CRITERIA)

THE FOLLOWING TERMINOLOGY SHALL BE FOLLOWED FOR ANNEXURE-I :

BIDDER MEANS BHEL

BIDDER'S SUB VENDOR MEANS THE RECIRCULATION PUMP MANUFACTURER

CONTRACTOR MEANS NTPC

4.00.00	QUALIFYING REQUIREMENTS FOR EQUIPMENTS/SYSTEMS			
4.01.00	Provenness criteria for critical equipment, auxiliaries, systems and bought out items: The Bidder / Bidder's sub-vendor(s) is required to meet the provenness criteria and/or qualification requirement for critical equipment, auxiliaries, system and bought out items as per criteria stipulated below:			
4.01.01	Booster Fans, Slurry Recirculation Pumps, Oxidation Blowers, Wet Limestone Grinding Mills, Slurry Pumps, Agitators & Vacuum Belt Filters for the Wet Limestone based Flue Gas Desulphurisation (FGD) System offered by the Bidder shall be only from such manufacturer(s) who has previously designed (either by itself or under collaboration / licensing agreement), manufactured / got manufactured the respective equipment(s) of the type, application and minimum equipment rating as stipulated below such that the respective equipment(s) should have been in successful operation in at least one (1) plant for a period not less than one(1) year reckoned as on 118 March 2019			
LOT-1A PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-0011-109-(1A)2	SUB-SECTION-I INTENT OF SPECIFICATION	PAGE 6 OF 19

CLAUSE NO.	INTENT OF SPECIFICATION				
	Type and Rating for Qualification				
	Sl. No.	Name of Equipment	Type of Equipment	Application	Equipment Rating
	(a)	Booster Fans	Axial type with variable pitch control	Coal fired power plant	80% of the flow & 100% of the head of the offered Booster Fan with Fan Speed 900 rpm (maximum)
	(b)	Slurry Recirculation Pumps	Centrifugal type	Wet Limestone based FGD application in Coal fired power plant	80% of the flow & 100% of the head of the offered Slurry Recirculation Pump
	(c)	Oxidation Blowers	Centrifugal/ positive displacement type blower	Wet Limestone based FGD application in Coal fired power plant	80% of the flow & 100% of the head of the offered Oxidation Blower
	(d)	Wet limestone Grinding mills	Horizontal Wet Ball mill	Wet Limestone based FGD application in Coal fired power plant	80% of the offered Ball mill capacity with pulverizing fineness not less than 90% thru 325 mesh
	(e)	Slurry Pumps	Centrifugal type	Wet Limestone based FGD application or ash slurry application in Coal fired power plant	80% of the flow & 100% of the head of the offered Slurry Pump(s)
	(f)	Agitators	Vertical/Horizontal	Wet Limestone based FGD application in Coal fired power plant	Agitator rating not less than that supplied for 500 MW or higher size unit for similar application
	(g)	Vacuum Belt filters	Belt type	Wet Limestone based FGD application in Coal fired power plant	80% of the offered Vacuum Belt filter capacity
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-0011-109-(1A)2		SUB-SECTION-I INTENT OF SPECIFICATION	PAGE 7 OF 19

CLAUSE NO.	INTENT OF SPECIFICATION	एनटीपीसी NTPC	
	Bidder shall offer and supply only the type of the above equipment(s) for which he himself or the manufacturer proposed by the bidder for the above equipment(s) is qualified. The provenness criteria for equipment (Booster Fans) stipulated at Sl. No. 4.01.01 (a) above shall also be considered acceptable provided the rating parameters (i.e., flow, head and rated rpm) is covered within the operating regime of the respective fan performance curve of the reference plant equipment.		
4.01.02	In case the Bidder or the proposed sub-vendor is not manufacturer of proven Booster Fans as per clause 4.01.01 (a) above but is a manufacturer of such equipment for units of at least 500 MW rating, the Bidder or the proposed sub-vendor can manufacture such equipment for 660 MW units also, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such equipment in India with such manufacturer who meet the requirements stipulated at clause 4.01.01 (a) above for the Booster Fans.		
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/ his sub-vendor(s) must create /have created manufacturing facilities at his works as per collaborator's/licenser's design, manufacturing and quality control system for such equipment(s). Further, in such a case, such qualified equipment manufacturers should have, directly or indirectly through its holding company/ subsidiary company, at least 26% equity participation in the Indian Joint Venture Company/ Subsidiary Company, which shall be maintained for a lock-in period of seven (7) years from the date of incorporation of such Joint Venture/ Subsidiary or upto the end of defect liability period of the contract, whichever is later.		
4.01.04	In case the Bidder or the proposed sub-vendor is not manufacturer of proven Oxidation Blowers as per clause 4.01.01 (c) above but is a manufacturer of Blowers/compressors for minimum 50 NM³/min capacity, the Bidder or the proposed sub-vendor can also manufacture Oxidation Blowers, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such Oxidation Blowers in India with such manufacturer who meet the requirements stipulated at clause 4.01.01 (c) above for the Oxidation Blowers. Before taking up the manufacturing of such equipment, the bidder/ his sub-vendor must create /have created manufacturing facilities at his works as per collaborator's /licenser's design, manufacturing and quality control system for such equipments.		
4.01.05	(i) In case the Bidder or the proposed sub-vendor is not manufacturer of proven Wet limestone Grinding mills as per clause 4.01.01 (d) above but is a manufacturer		
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-0011-109-(1A)2	SUB-SECTION-I INTENT OF SPECIFICATION
			PAGE 8 OF 19

CLAUSE NO.	INTENT OF SPECIFICATION	एनटीपीसी NTPC		
4.01.06	of dry Grinding mills for power or cement industry of minimum 20 T/h capacity; the Bidder or the proposed sub-vendor can also manufacture Wet limestone Grinding mills, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such Wet limestone Grinding mills in India with such manufacturer who meet the requirements stipulated at clause 4.01.01 (d) above for the Wet limestone Grinding mills. Before taking up the manufacturing of such equipment, the bidder/ his sub-vendor must create /have created manufacturing facilities at his works as per collaborator's /licenser's design, manufacturing and quality control system for such equipments. In addition, the Bidder along with the qualified equipment manufacturer 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 in the bidding document. The DJU shall be submitted prior to the placement of order on the approved sub-vendor for Wet limestone Grinding mills. In case of award, each executant of the DJU except the Bidder shall be required to furnish an on demand bank guarantee for INR 10 Million (Indian Rupees Ten Million only) for each project. OR (iii) In case, the bidder or proposed sub-vendor is not a manufacturer of proven Wet Limestone Grinding Mills as per clause 4.01.01 (d) above, but have designed, manufactured & supplied dry Grinding Ball Tube mills for at least 500 MW pulverized coal fired power plant, the Bidder or the proposed sub-vendor can also manufacture Wet limestone Grinding Mills provided it has a licensing agreement with a Wet limestone Grinding mills manufacturer who meet the requirements stipulated at clause 4.01.01 (d) above for the Wet limestone Grinding mills and provides extended warranty of three (3) years for the Wet Limestone Grinding Mills. In such a case Bidder shall provide an additional on demand bank guarantee for INR 10 Million (Indian Rupees Ten Million only) for each project.			
	OR (iii) In case, the bidder or proposed sub-vendor is not a manufacturer of proven Wet Limestone Grinding Mills as per clause 4.01.01 (d) above, but have designed, manufactured & supplied dry Grinding Ball Tube mills for at least 500 MW pulverized coal fired power plant, the Bidder or the proposed sub-vendor can also manufacture Wet limestone Grinding Mills provided it has a licensing agreement with a Wet limestone Grinding mills manufacturer who meet the requirements stipulated at clause 4.01.01 (d) above for the Wet limestone Grinding mills and provides extended warranty of three (3) years for the Wet Limestone Grinding Mills. In such a case Bidder shall provide an additional on demand bank guarantee for INR 10 Million (Indian Rupees Ten Million only) for each project.			
	In case the Bidder or the proposed sub-vendor 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.			
4.01.07	In case the Bidder or the proposed sub-vendor is a manufacturer of Slurry Pumps who meets the requirements stipulated at clause 4.01.01 (e) above, the Bidder or the proposed sub-vendor can also manufacture Slurry Recirculation Pumps,			
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-0011-109-(1A)2		SUB-SECTION-I INTENT OF SPECIFICATION
				PAGE 9 OF 19

CLAUSE NO.	INTENT OF SPECIFICATION
	provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such equipment in India with such manufacturer who meet the requirements stipulated at clause 4.01.01 (e) above for the Slurry Recirculation Pumps. Before taking up the manufacturing of such equipment, the bidder/ his sub-vendor must create /have created manufacturing facilities at his works as per collaborator's /licenser's design, manufacturing and quality control system for such equipment.
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 / its sub vendor(s) must create (or should have created) manufacturing and testing facilities at its works as per Collaborator / licensor'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.
4.01.09	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.
4.01.10	The Employer reserves the right to fully satisfy himself regarding capability and capacity of Bidder / its sub-vendor(s) and the proposed arrangement and may prescribe additional requirement before allowing manufacture of the equipment listed above for this contract.
	Note to clause 4.01.01 (1) Whenever the term 'coal fired' is appearing above, "Coal" shall be deemed to also include bituminous coal/brown coal/Anthracite Coal/lignite.

**FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE
FOR
LOT-1A PROJECTS
BIDDING DOCUMENT NO. CS-0011-109(1A)-2**

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 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 :

--

B. Slurry Recirculation Pumps: 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 Slurry Recirculation Pumps of minimum 80% of the flow & 100% of the head of the offered Slurry Recirculation Pump. Centrifugal type working in a 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 operating in a Wet Limestone based FGD application in Coal fired power plant	- *Yes/*No
5.	Name of equipment manufacturer & address:	
6.	Date of commission of the equipments:	
7.	Model no. of the equipment:	
8.	Brief Technical particulars of the equipments:	
9.	Flow-	m ³ /h

Sl. No.	Description	Reference Work
10.	Head-	 meters of liquid column
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/ *Drawing 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 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:

LOT-1A PROJECTS
FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE BID DOCUMENT NO.: CS-0011-109(1A)-2

***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 proveneness 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.

LOT-IA PROJECTS

FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE

BID DOCUMENT NO.: CS-0011-109(1A)-2

***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 provenness 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/licensor'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 proveneness 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 VVet 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 provenness 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.

LOT-1A PROJECTS

FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE

BID DOCUMENT NO.: CS-0011-109(1A)-2

(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)

8.02.00

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

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.

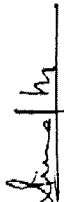
(Data to be furnished in line with format given at 1.00.00 of this Attachment)

MANUFACTURER'S NAME AND ADDRESS		STANDARD QUALITY PLAN									
M/S BHEL: BAP: RANIPET 632 406 TAMIL NADU		ITEM: RECIRCULATION PUMP SYSTEM: FGD		QP NO		FGS:723		REV. NO:		00	
				DATE:		12.02.2019		PAGE NO:		Page 1 of 3	
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS	
1.	2.	3.	4.	5.	M C/N	7.	8.	9.	M C N	11.	
1.0 RAW MATERIALS											
1.1	Volute Casing, Casing Cover	Chemical & Mechanical Properties	Major	Composition analysis & Mechanical Properties test	1 Sample / Heat	Approved GA Drawing / Data Sheet/ Specification	MTC	✓	P	V	V
1.2	Impeller, Wear Plate SS	Chemical & Mechanical Properties	Major	Composition analysis & Mechanical Properties test	1 Sample / Heat	Drawing & Specification	MTC	✓	P	V	V
1.3	Volute Casing	Surface Defects	Major	DPT on machined surface	100%	ISO4987	ASME Sec V	DPT Report	✓	P	V
1.4	Shaft	Chemical Composition	Major	Chemical composition	1 Sample/Heat	Drawing/Specification		Test Report	✓	P	V
		Mechanical Properties		Test Report				✓	P	V	
		Hardness Test		Test Report				✓	P	V	
1.5	Impeller	Internal Soundness	Major	UT	100%	ASTM A 388/	ASME Sec V	UT Report	✓	P	V
		Surface & Sub Surface Defects		MT-on m/c Surface				MT Report	✓	P	V
1.5	Impeller	Surface & Sub Surface Defects	Major	DPT	Accessible Areas	ISO4987	ASME Sec V	PT Report	✓	P	V
2.0 IN PROCESS INSPECTION											
2.1	Impeller/Volute Casing/ Wear Plate	Surface Condition/ Defects/	Major	Visual and Measurement	100%	Drawing		IR (Protocol)	P	-	-
LEGEND: * RECORD, IDENTIFIED WITH "TICK" (✓) UNDER COLUMN 'D' SHALL BE SUBMITTED TO CUSTOMER AS A QA DOCUMENTATION PACKAGE.						PREPARED BY					
M: MANUFACTURER / SUB SUPPLIER, C: MAIN CONTRACTOR.											
N: CUSTOMER/CONSULTANT P: PERFORM W: WITNESS V: REVIEW OF RECORDS						REVIEWED & APPROVED BY					
MA: MAJOR AND MI: MINOR											
						K C Gandhi Parimalam, (DGM/QA)					

STANDARD QUALITY PLAN												
MANUFACTURER'S NAME AND ADDRESS				ITEM: RECIRCULATION PUMP SYSTEM: FGD								
 Ranipet M/S BHEL: BAP: RANIPET 632 406 TAMIL NADU				QP NO REV. NO: DATE: PAGE NO:								
				FGS:723 00 12.02.2019 Page 2 of 3								
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.
	SS/ Casing Cover/ Shaft After Machining	Measurement										
2.2	Couplings/Other Parts/Semi finished Products	Verification	Major	Compliance With Order	100%		Drawing		COC	P	-	Spot Check by BHEL
2.3	Rotating Parts	Balancing	Major	Static & Dynamic Balancing	100%		ISO 1940	ISO 1940, grade 2.5	Balancing Report	P	V	V
2.4	Volute Casing	Water Pressure (Static) Testing	Major	Static Pressure Testing of Casing	100%		See Remarks Column	No Leakage	Test Report	P	W	Test Pressure at 2x rated head or 1.5x shut of head whichever is higher for 30min
3.0 FINAL INSPECTION												
3.1	Complete Pump Assembly	Completeness	Major	Visual & Dimensional	100%		Manufacturer Drawing		IR	✓	W	W
		Measurement- Flow vs Head(Complete operating range), Power, Efficiency	Major	Performance testing of pump	100%	*	Approved Drawing /Data Sheet		Performance Test Report	✓	W	W
		Vibration Velocity RMS [MM/S] Bearing Temperature Noise		Measurement	100%	*	Approved Drawing. Approved Data Sheet		Performance Test Report	✓	P	W
LEGEND: * RECORD, IDENTIFIED WITH "TICK" (✓) UNDER COLUMN 'D' SHALL BE SUBMITTED TO CUSTOMER AS A QA DOCUMENTATION PACKAGE.							REVIEWED & APPROVED BY					
M: MANUFACTURER / SUB SUPPLIER, C: MAIN CONTRACTOR.							PREPARED BY			 Rakesh Kumar Madhu,(SER/QA)		
N: CUSTOMER/CONSULTANT P: PERFORM W: WITNESS V: REVIEW OF RECORDS MA: MAJOR AND MI: MINOR										K C Gandhi Parimalam,(DGM/QA)		

MANUFACTURER'S NAME AND ADDRESS		STANDARD QUALITY PLAN											
M/S BHEL: BAP: RANIPET 632 406 TAMIL NADU		ITEM: RECIRCULATION PUMP SYSTEM: FGD				QP NO	FGS:723						
						REV. NO:	00						
						DATE:	12.02.2019						
						PAGE NO:	Page 3 of 3						
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY	REMARKS	
1.	2.	3.	4.	5.	M	C/N	7.	8.	9.	D*	M	C	N
		Level RMS[MM/S]											
		NPSH Test	Major	Measurement	1 Pump / each type / design		Design Standard of Pump		NPSH Test Report	✓	P	W	W
3.2		Leakage Test	Major	Leakage Testing	100 %	*	Approved Ga Drawing & Data Sheet		IR	✓	P	W	W
3.3		Strip Down Test Not Required If Performance Test is Fine	Major	Visual	100%		Mfg. Drawing, Approved Data Sheet			✓	P	W	W
3.4	Painting	Dry Film Thickness/Color	Major	Visual & Measurement	Spot Check		Approved Painting Scheme		IR(Protocol)	✓	P	V	V
4	DOCUMENTATION												
4.1	Check of Quality Assurance Documentation	Compliance to MQP	Major	Check of Compliments	100%		Manufacturing Quality Plan		Protocol	✓	V	V	V

NOTE: Electrical Motor for Recirculation Slurry Pump is in BHEL Bhopal Scope. Separate MQP to be submitted for Motor.

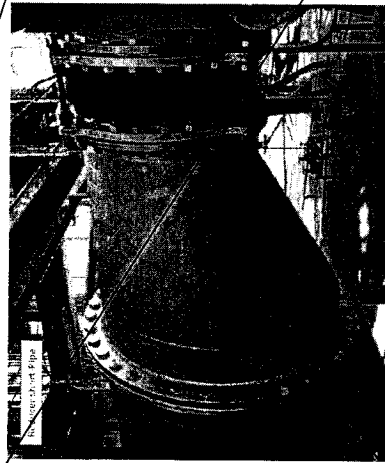
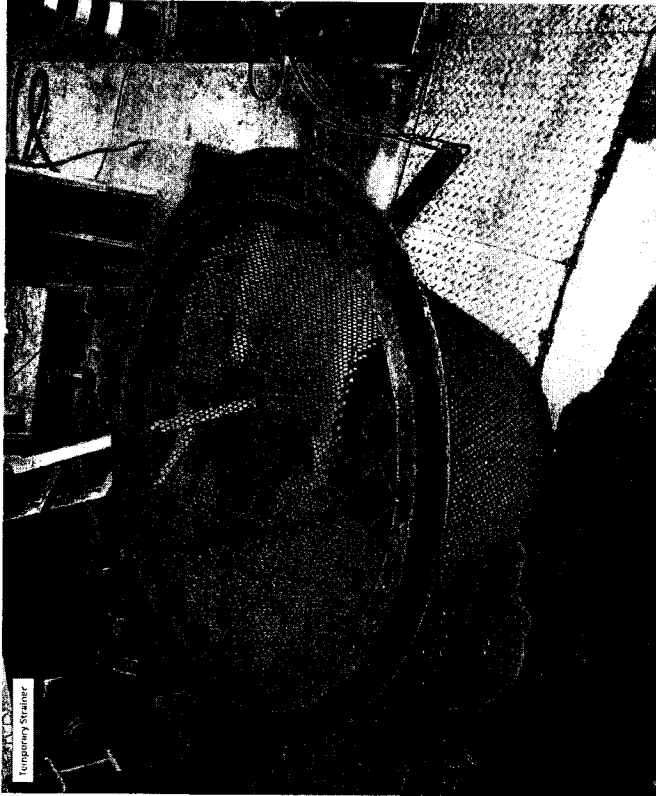
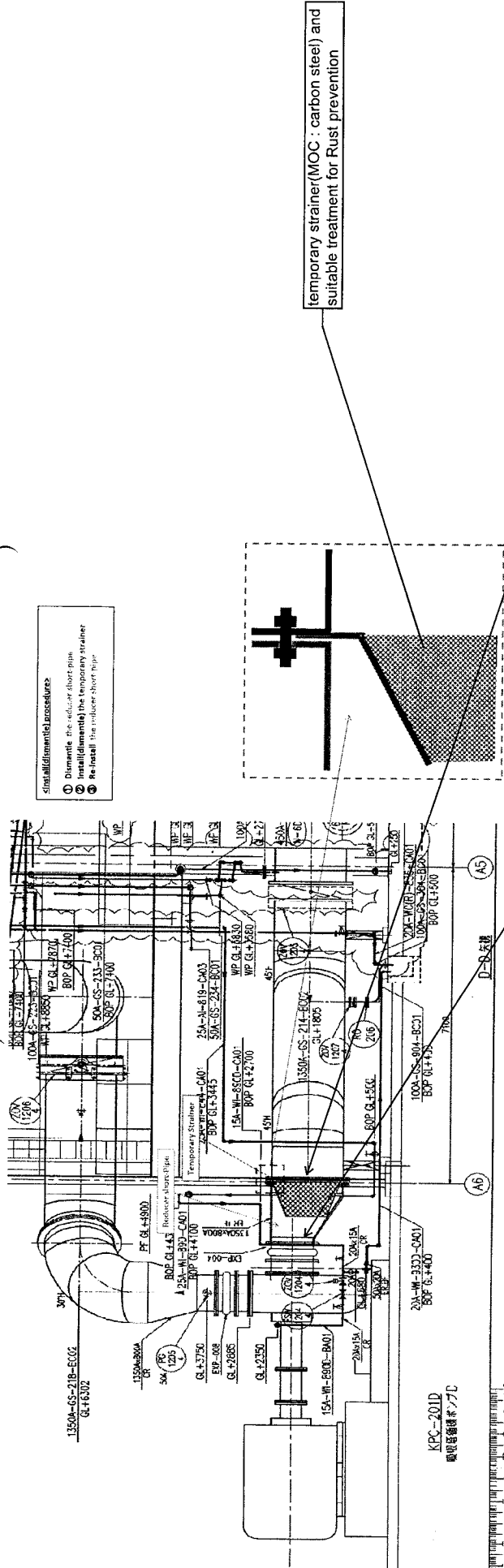
LEGEND: * RECORD, IDENTIFIED WITH "TICK" (✓) UNDER COLUMN 'D' SHALL BE SUBMITTED TO CUSTOMER AS A QA DOCUMENTATION PACKAGE. M: MANUFACTURER / SUB SUPPLIER, C: MAIN CONTRACTOR. N: CUSTOMER/CONSULTANT P: PERFORM W: WITNESS V: REVIEW OF RECORDS MA: MAJOR AND MI: MINOR	PREPARED BY  Rakesh Kumar Madhu, (SER/QA)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

Annexure-VIII- Instruments specification



CLAUSE NO.	TECHNICAL REQUIREMENTS		
3.02.00	Resistance Temperature Detector (RTD)		
	Sr. No.	Features	Essential/Minimum Requirements
	1	Type of RTD.	: Four wire, Pt-100 (100 Ohms resistance at zero degree Centigrade).
	2	No. of element	: Duplex
	3	Housing/Head	: IP-65/Diecast Aluminium. Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter (as applicable). Plug in connectors are to be provided for external signal cable connection. TE terminal head shall be spring loaded for positive contacts with the thermo well
	4	Insulation and sheathing of RTD	: Mineral (magnesium oxide) insulation and SS316 sheath,
	5	Calibration and accuracy	: As per IEC-751/ DIN-43760 Class-A for RTD
	6	Accessories	: Thermo well and associated fittings
	7	Standard	: IEC-751/ DIN-43760 for RTD and ASME PTC-19.3 for Thermo-well.
	NOTES :		
	1)	The specifications for RTDs of winding/ bearings of motor/pump, can be as per their manufacturer standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice. However the type of RTD shall be Pt100.	
	2)	The specifications of temp elements for air conditioning & ventilation system / process can be as per system manufacturer's standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice.	

Annexure-X - Typical Drawing of the Temporary Strainer



Bidder to design the face dimension and expansion bellow size depending on the pump

Expansion bellow
(typical)

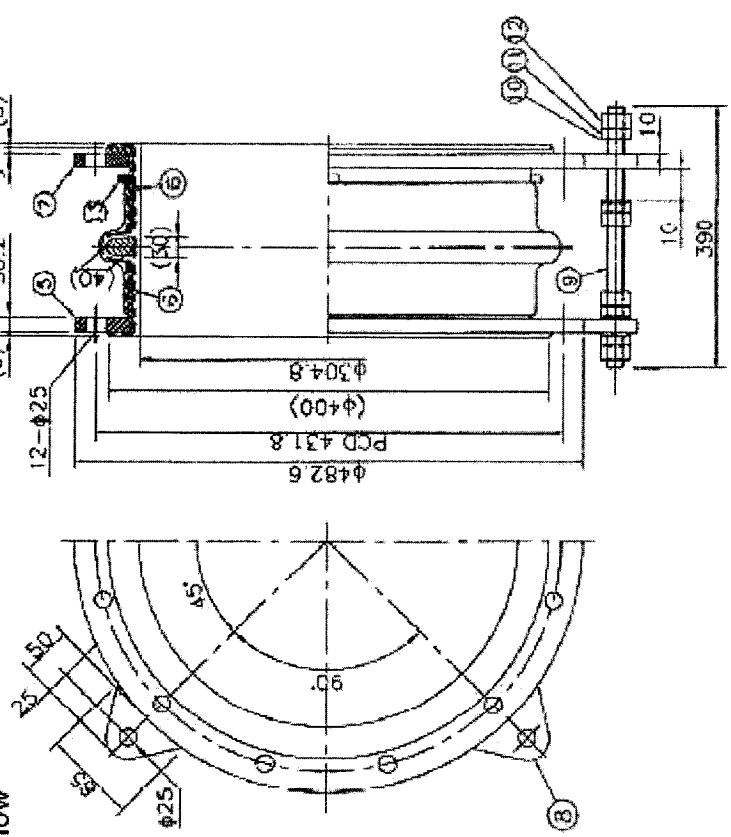


Fig. 01

PAINING

- Surface Preparation : So 2.5
- Under Coating : Inorganic Zinc Primer
75µm/one coat
- Second Coating : High build polyamine adduct
cured epoxy top coat
35µm/one coat
- Finish Coating : High build polyamine adduct
cured epoxy top coat
125µm/two coat

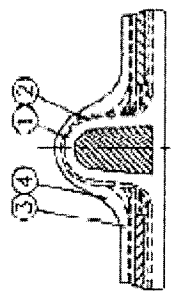
Total minimum 360µm

Axial and lateral movement : +/- 10 mm

Note: CR Rubber to be covered on the face of the
flange

CAREER

MARK DATE EXPLANATION



DETAIL OF CONSTRUCTION

13	STOPPER	4	
12	NUT	4x4	M22
11	LOCK NL	4x4	M22
10	WASHER	4x4	M22
9	CONTROL BOLT	4	M22
8	CONTROL PLATE	4x2	
7	LOOSE FLANGE	1	ANSI 150Lb 12"
6	NIPPLE	2	
5	FLANGE	1	ANSI 150Lb 12"
4	RUBBER OUTER COVER	1	EPDM 2.5 mm
3	REINFORCING FABRIC	1	CHEMICAL FIBER 1 P
2	REINFORCING CORD	1	CHEMICAL FIBER 4 CP
1	RUBBER INNER TUBE	1	CR 6 mm
PART NO.	NAME OF PART	NO. REQ'D	MATERIAL
RUBBER EXPANSION JOINT 12" x 1 ARCH x 30QL			
USER	DATE BY:		
DATE	SCALE		
DWG No.	APPROVED BY		