

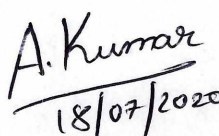
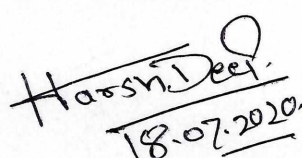
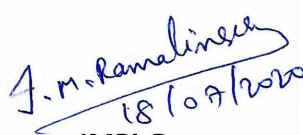
Technical Specification ROS: 9070

For

Absorber Recirculation Pumps



Customer : NATIONAL THERMAL POWER CORPORATION (NTPC)
Project : BONGAIGAON 3X250MW (G305, G306 & G307)
Application : FLUE GAS DESULPHURIZATION SYSTEM

Department	Prepared	Checked	Approved
WS	 18/07/2020 Abhinav Kumar Sr. Engineer-WS	 18-07-2020 Harsh Dep Dy. Mgr.-WS	 18/07/2020 IMRL Rao Sr. Mgr. -WS
ROS : 9070 Rev00; Dated : 18/07/2020		COMMENTS : -----	

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**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BONGAIGAON (3X250 MW)**

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1.0 PROJECT INFORMATION:

Bongaigaon Thermal Power Project (3X250MW), a pithead coal based thermal power project, is located in Kokrajhar district of Assam State. Basic inputs i.e. coal; water and land are already tied up. The project is proposed for the States & Union Territories of Northern, Western and Eastern Regions.

The project comprises Three (3) units 250MW 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 Guarantee Values as well as for the Guarantee test/Performance test
- 2) Equipment and Material shall be suitable for the range of ambient site conditions.

B) PROJECT LOCATION AND APPROACH

a.	State/Division	Assam
b.	District	Kokrajhar

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 only.



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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. The following points may be noted.

- a. A total of 12 nos Recirculation pumps are required. (4 No's of RC pumps each unit.)
- b. Bidder shall take full responsibility for the entire equipment assembly and make all efforts to comply strictly with the requirements of this specification and other relevant specifications/attachments to inquiry/order.
- c. In the event bidders' consider that deviations are essential, 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)".
- d. Any deviation, not listed in Annexure - IV, though reflected in any other part of the offer, shall not be considered.
- e. BHEL discretion is final in acceptance / rejection of exceptions / deviations listed by Bidders' proposal in Annexure – IV. Only written approval by BHEL is valid means of acceptance of deviation / exception.
- f. In case, Bidder considers requirement of additional instrumentation, controls, safety devices and any other accessories/auxiliaries essential for safe and satisfactory operation of the equipment shall be recommended along with reasons in a separate section and included in scope of supply.
- g. Bidder shall ensure completeness of the Slurry Recirculation Pump in all respects and provide all necessary components, instruments and fulfil statutory requirements required to make the system complete for its safe, efficient, reliable, trouble free operation and maintenance irrespective of mention in the specification unless specifically excluded by BHEL.

4.0 PROVENNESS CRITERIA:

Bidders shall meet the Qualification Requirement (QR) for Recirculation Pumps as per **Annexure-I & submit the Annexure to qualification requirement (Attachment-3K)**. Offers of Bidders not meeting Qualification Criteria shall not be considered for evaluation.

5.0 TECHNICAL INFORMATION – Properties of Fluid being Handled & Physical data.

S.No	Description	Requirement
1.	Quantity	
	Quantity of Recirculation Pumps for Unit-1	4 no's (3 working + 1 standby)
	Quantity of Recirculation Pumps for Unit-2	4 no's (3 working + 1 standby)
	Quantity of Recirculation Pumps for Unit-3	4 no's (3 working + 1 standby)



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S.No	Description	Requirement
	Total	12 no's
2.	Parameters	
	Pump Design capacity	10100 m ³ /hr.
	Pump discharge head (excluding suction head)	16.7 m (Liquid Column)
	Medium to be handled	Gypsum slurry
	Operating Temperature	~61° 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
	Expansion Joint / Bellows	Expansion joint / bellows shall be provided at suction and discharge of each pump.
	Noise	≤ 85 dB at 1.0 meter distance.
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 below 200KW lighting and domestic power outlets
	Bidder shall design and supply equipment suitable for satisfactory operation as per above mentioned power supply condition.	

5.1 SLURRY ANALYSIS

S.No	Constituents	Parameters
1.	Slurry to be handled	Gypsum Slurry
2.	Chloride Content	<25,000 ppm
3.	Specific Gravity at pump section	1.202 t/m ³ @design (for motor design) and 1.201 t/m ³ @ guarantee point(for guarantee parameters)
4.	Vapor Pressure at Pump	0.196 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)	59.2 deg c(normal) 70 deg c(max)

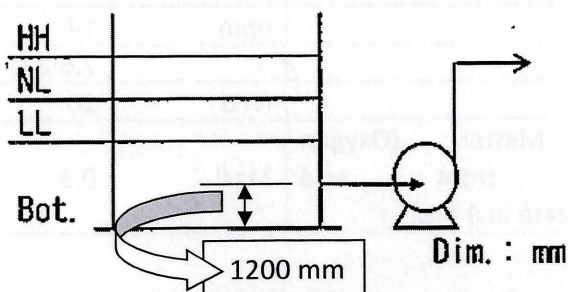


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5.2 ABSORBER TANK LEVEL

HH	Bottom	6500	For Reference Only
NL	Bottom	5500	For Reference Only
LL	Bottom of Tank	4200	Use for Calculation of NPSH



S.No	NPSH Calculation Results	Value (Meters)	
1	NPSH available *	9.62	NPSH available arrived based on following considerations: 1. LL level of the tank as 4.20 m 2. Suction line center assumed 1.20 m from the bottom of absorber Tank. Note: If suction height changes, NPSH value shall be accordingly arrived by the vendor.

***Note:** Bidder shall ensure that the required NPSH shall be less than available NPSH by 1.0 mtr as a minimum.

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	120.2
2.	Total Anions as CaCO_3	ppm	120.2
3.	Calcium as CaCO_3	ppm	75.2
4.	Magnesium as CaCO_3	ppm	30
5.	Sodium as CaCO_3	ppm	15
6.	Potassium as CaCO_3	ppm	Nill
7.	Iron as Fe	ppm	Nill



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8.	Nitrates as CaCO ₃	ppm	Nil
9.	Bicarbonates as CaCO ₃	ppm	65.7
10.	Carbonates as CaCO ₃	ppm	65.7
11.	Chlorides as CaCO ₃	ppm	22
12.	Sulphate as CaCO ₃	ppm	32.5
13.	Silica	ppm	14
14.	pH		7.6-8.0
15.	Turbidity	NTU	10
16.	Organic Matter (Oxygen absorbed from acid Permanganate in 4 hrs)	Mg/l	0.3

Note: Clarified water is used from Condenser Cooling (CW) Water system as make up and flushing requirement. The CW system is expected to operate at about 2.0 - 2.5 cycles of concentration (COC) with suitable chemical treatment program using acid, scale & corrosion inhibitor dosing

5.4 OPERATION & PUMP PERFORMANCE

a) Operation Mode of Pumps: The pumps operations are as follows. Pumps shall cover the entire operation mode

1. No of Boilers-3 No's
2. Four (04) pumps (3 working + 1 standby) connected to the common header of the recirculation line per boiler
3. Operating modes of pumps:
 - (1) Sequential startup of the pumps one after the other.
 - (2) Three (03) Pumps in continuous operation per boiler
 - (3) Sequential shut down of pumps one after the other.
 - (4) Emergency shutdown of maximum four (04) pumps per boiler at the same time in case of power failure. In such case, the discharge valve of the pumps shall be fully closed within 15 sec. Pump shall endure reverse flow until the 15-second duration.
4. Table-1 Pump Operating condition
Bidder shall provide the Shaft Power required based on the inputs provided by BHEL with reference to Flow and Available Head taking into consideration requirements spelt out in this document t.

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

- (1) The capacity of the pump (design Condition) shall be 10100 m³/hr. with a discharge head of 16.7 m Liquid Column (excluding suction head)
- (2) Shaft power at design conditions specified in clause 3 (2) shall be kept as minimum as possible (overall pump efficiency shall not be less than 87%) and shaft power shall be guaranteed by vendor.



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6.0 SCOPE OF SUPPLY

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

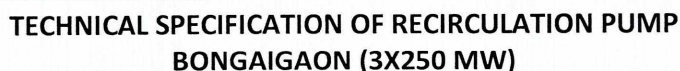
Design: Includes basic engineering, detail engineering, preparation and submission of engineering drawings/calculations/datasheets/quality assurance documents/field quality plans, storage instructions, commissioning procedures, operation & maintenance manuals, performance guarantee test procedures and 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. Coupling arrangement between Motor & Pump
	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
	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 applicate
	xi. Bearing cooling if applicable
	xii. Lubrication system
	xiii. Foundation bolts for supplied items
	xiv. Mechanical Running and Performance test at shop
	xv. Instrument : PG, bearing temp sensor, as per requirements
	xvi. Painting and Rust Prevention
	xvii. Supervision of Erection & commissioning at site
	xviii. Special tools & tackles as applicable
	xix. Erection and start-up spares, 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 exclusions with prior approval of BHEL.



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	3000 rpm	50.0 micron	65.0 micron	
	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 (as per API 610 standard)			
15.	The pumps shall be capable of starting with discharge valve fully open and closed condition. The motor drawing and technical data are annexed to this specification. Bidder shall match the interface details and share the outline & GAD drawing for review. Please refer to Clause F (a) – Base Plate in this specification also. Bidder shall review the Motor Data and confirm suitability with respect to maximum power requirement at any condition of the entire characteristic curve of the pump. Bidder to provide the details for review by BHEL. (Motor supply is in BHEL scope)			
16.	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.			
17.	The pumps shall be able to sustain forces owing to reverse rotation up to 150% of design RPM, at full discharge head in the event pump trips while the other operating pump remain on line. Bidder shall provide proof of design incorporation the requirement of this clause			
18.	Pumps shall have stable head-capacity characteristics curve from run-off to shut-off. Shut-off head shall be minimum 125% of Best Efficiency Point (BEP).			
19.	A factor of 1.2 for “Froth” shall be taken into account for sizing the pump. If Bidder, from their own experience, specifies that froth factor need not be taken into account or a different factor to be taken into account for FGD pump, the same shall be clearly specified. Suction size of the pump shall be adequate to take additional capacity and the same shall reflect in master curve. Suction specific speed of pump shall not exceed $N_s=160$ (metric), inclusive of the “Froth factor”.			
20.	External flushing shall be provided to remove the accumulated particles immediately after shut down. All related information shall be provided for review & mentioned in data sheet.			
21.	Pump shall have adjustment provision of axial clearance between casing and impeller to ensure performance at best efficiency in the event of wear between impeller and casing.			
22.	In case rubber or nonmetallic linings are used, shall be two piece molded under pressure and adjusted to the screwed metallic clamping welded to the casting.			
23.	Each pump shall have a coupling of adequate size, designed for full load, capable of supporting start –Up and overload moment. Each half of the coupling will be factory mounted and locked to its shaft. The coupling shall be able to accept adjustment of the impeller.			
24.	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). Thrust bearing shall be designed for a minimum of 175 % of Design load.			
25.	The pumps shall have mechanical seals of cartridge type with self-lubrication sliding ring cartridges. The static part is mounted on the seal plate with circumferential ring (O-ring) or another flexible sealing ring. Built in seal design shall not be accepted.			



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26.	The sealing areas shall be designed in such a way so that solids do not precipitate, affect the cooling, or affect adjustment and mechanical functioning of the seals. Seals requiring jet cleaning shall be avoided.																																													
27.	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).																																													
28.	Make of Bearings: SKF /FAG or equivalent subject to BHEL approval.																																													
6.2	CONSTRUCTIONAL FEATURES																																													
	MOC approved by the customer for RC pumps is given below. Vendor shall offer same/equivalent MOC or higher grade MOC																																													
	<table><tr><th>Sl.No.</th><th>Parts Description</th><th>MOC</th></tr><tr><td>1.</td><td>Suction bell /casing</td><td>EN-JGS-400-15U (Spheroidal Graphite Iron)</td></tr><tr><td>2.</td><td>Casing wear plate</td><td>SIC cast</td></tr><tr><td>3.</td><td>Casing liner</td><td>25mm thk, SIC cast</td></tr><tr><td>4.</td><td>Impeller</td><td>16mm thk, SIC cast / 0.7040 [~A536-80 Gr. 60-40-18]</td></tr><tr><td>5.</td><td>Impeller Hub</td><td>EN-JGS-400-15U (Spheroidal Graphite Iron)</td></tr><tr><td>6.</td><td>Wearing Rings</td><td>SIC only suction side wear plate applicable</td></tr><tr><td>7.</td><td>Impeller shaft</td><td>1.0503 CK45 [~ AISI (SAE) 1045]</td></tr><tr><td>8.</td><td>Shaft sleeve</td><td>1.4571 [~A276 316 Ti]</td></tr><tr><td>9.</td><td>Shaft coupling</td><td>1.0570 (St52) [~ ASTM A572]</td></tr><tr><td>10.</td><td>Thrust bearing</td><td>DIN 728/1 29334 E</td></tr><tr><td>11.</td><td>Base plate</td><td>1.0570 (St52) [~ ASTM A572]</td></tr><tr><td>12.</td><td>Sole plate</td><td>1.0570 (St52)[~ ASTM A572]</td></tr><tr><td>13.</td><td>Fasteners in pump assembly</td><td>Stainless steel</td></tr><tr><td>14.</td><td>Mechanical seal seal faces</td><td>SiSiC</td></tr></table>	Sl.No.	Parts Description	MOC	1.	Suction bell /casing	EN-JGS-400-15U (Spheroidal Graphite Iron)	2.	Casing wear plate	SIC cast	3.	Casing liner	25mm thk, SIC cast	4.	Impeller	16mm thk, SIC cast / 0.7040 [~A536-80 Gr. 60-40-18]	5.	Impeller Hub	EN-JGS-400-15U (Spheroidal Graphite Iron)	6.	Wearing Rings	SIC only suction side wear plate applicable	7.	Impeller shaft	1.0503 CK45 [~ AISI (SAE) 1045]	8.	Shaft sleeve	1.4571 [~A276 316 Ti]	9.	Shaft coupling	1.0570 (St52) [~ ASTM A572]	10.	Thrust bearing	DIN 728/1 29334 E	11.	Base plate	1.0570 (St52) [~ ASTM A572]	12.	Sole plate	1.0570 (St52)[~ ASTM A572]	13.	Fasteners in pump assembly	Stainless steel	14.	Mechanical seal seal faces	SiSiC
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A)	CASING																																													
a.	The pump casing shall be radially split for ease of maintenance and designed such that the impeller and shaft can be 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 shall be fitted with a coupling to facilitate disassembly without Motor removal.																																													
b.	The casing and flanges shall be designed to withstand the maximum shut-off pressure developed by the pump at the pumping temperature.																																													
c.	Pump casing shall be designed with a corrosion allowance to meet the requirement “Technical requirements” and taking into account the “Operating Parameters”.																																													
d.	Bidder shall provide for suction and discharge pressure gauge as a standard feature. Same shall reflect in the drawings.																																													



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e.	Lifting lugs shall be provided for the pump as a whole and individual casing halves as per standard material handling procedures and OSHA guidelines.
f.	Pump casing shall be provided with a vent connection and piping with valves and fittings. Casing drain shall be provided complete with drain valves suitably.
g.	All the wear parts of the pump shall be guaranteed for a minimum wear life of not less than 14000 hrs.
h.	Renewable wear rings shall be provided at points of running clearance and shall be made from appropriate materials. Details shall be shared during Technical Bid for evaluation and record
B)	IMPELLER
a.	Impeller material shall be a Silicon Carbide material.
b.	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
c.	Impellers shall be designed and furnished such that there shall be a feasibility to install a new impeller to facilitate increased Head of at least 5% over and above the specified value. Same shall be supported by documentary evidence for evaluation of Bid
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.	Mechanical seals chamber shall have sufficient room to lubricate and ensure seal face cooling by flowing 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. Offers with Hook sleeve cartridges shall be summarily rejected without intimation to Bidder.
e.	Requirement of flushing water, its quantity, and pressure to be indicated in data sheet.
f.	Pump shall have provision of collecting drip leakage (minimum volume) if any and flush out the same to nearby pit without corroding any entity around the vicinity 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.	Seal life shall be guaranteed for 20000 hrs. In the event seals fail before guarantee period, the bidder shall replace the same without any cost implication.
i.	Make of Mechanical Seals: Eagle Burgmann/ Flowserve/ John crane only. No other make is acceptable



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D)	SHAFT AND SHAFT SLEEVE
a.	Pumps shall operate smoothly throughout the speed range up to 110% of operating speed. The critical speed shall be well away from the operating speed and in no case be less than 130% of the rated speed. The determination of the shaft diameter and the distance between two consecutive bearings shall include a sufficiently large safety margin to satisfy this requirement.
b.	Lubrication system shall have a sight glass for visual inspection of lubricant level.
c.	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 to enable distinguish leakage between shaft and shaft sleeve and that past the seals/gland. Shaft sleeve shall be CD4M Cu ASTM A-743 or equivalent. Manufacture shall indicate the shaft sleeve diameter in data sheet.
d.	Shaft shall have either a keyed joint or a threaded connection between impeller and shaft.
E)	COUPLING
a.	The HT drive motor excluded from the scope of supply. However, bidder shall supply coupling.
b.	Coupling halves shall be machine matched to ensure accurate alignment. Couplings shall have a rated capacity of at least 120% of the maximum potential power transmission requirement.
c.	Coupling shall be of flexible type as per application standard. The Bidder shall furnish both halves of the coupling. Both the Coupling halves shall be bored and keyed to fit shafts. Relevant datasheets of coupling shall be furnished for review & record.
d.	All exposed rotating parts shall be covered with suitable protective guards. Guards shall be easily removable type. Coupling halves with masses > 15 kgs shall have provision of tapped hole on the hub for handling
F)	BASE PLATE
a.	The Bidder shall match the Base plate of the pump to the Foundation locations provided in the Annexure to this specification. Please refer to Clause 6.1 – 15, Technical requirements. Bidder shall provide outline & General Arrangement Drawing of the complete Arrangement including the base plate along with the offer for review.
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.	Motor details shall be furnished to bidder for review by Bidder
d.	Base plate shall 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 shall supply base plate along with Foundation bolts & Nuts, "Taper wedge"



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	and the necessary fasteners for Pump and Motor with Base plate. Motor is excluded from scope of supply. Necessary fasteners for motor foot with base plate shall be in pump vendor's scope of supply.						
f.	Base plate shall be provided with a trough, material of which shall be compatible to the pumping liquid. Leaked liquid, if any shall be collected in a trough and routed to a designated point						
g.	Base frame shall be epoxy coated with proper finishing.						
G)	ACCESSORIES:						
1.	Expansion bellows:						
i.	Expansion Bellows (with Tie Rod Arrangement) with limiting bolt & nut shall be provided at suction and discharge of each pump. Bidder to submit the GA drawing for review.						
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 AP1 670, 15th edition. Provision shall be plugged suitably to prevent entry of foreign particles. Provision for measuring casing Vibration shall also be provided at measuring locations. Same shall be indicated by the Bidder in the drawing being submitted along with the offer.						
iv.	Alarm Signal: Bearing temperature sensor for alarm during when "Bearing Temperature high" shall be supplied by Bidder. The following instruments shall be provided for each pump and the same shall be wired to a junction box for onward termination to DCS & control room for monitoring and control. Wiring shall be protected by armoured / sheathed conduit appropriately : <table><tr><th>S.No.</th><th>Description</th><th>Min Qty /pump</th></tr><tr><td>1</td><td>Pump Bearing TE RTD PT100 DUPLEX</td><td>6 nos. (3 nos. at drive end & 3nos. at non drive end)</td></tr></table>	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)
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)					



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BONGAIGAON (3X250 MW)**

BONGAIGAON:WS:ARP: ROS 9070

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. 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.
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.	Suitable drain connections shall be provided.
7.	The equipment shall be suitable for stable operation continuously.
8.	Service life:- Entire equipment except wear parts shall be designed and fabricated for a minimum service life of 20 years of operation.
9.	Corrosion allowance: Corrosion allowance for entire equipment shall be in accordance with latest applicable Indian / International standard.
10.	Unless otherwise specified , flanges shall be in accordance with ANSI B16.5 Class 150, ASME 16.47 ; AWWA C-207 CLASS D
11.	Name plate: All equipment shall be provided with nameplates indicating the item number and service name. Nameplates shall be of 304 Stainless steel plate and placed at a readily visible location. Nameplate of main equipment shall have enough information, which will be confirmed during engineering phase. Stainless steel nameplates for all instruments and valves shall be provided.
12.	Rotation arrows shall be cast in or attached with stainless steel plate on each item of rotation equipment at a readily visible location.
13.	Unless otherwise specified, all equipment items where the weight exceeds 15 kg shall be provided with suitable lifting lugs, ears or ring bolts or tapped holes for lifting rings. Minimum shock factor for lifting lugs shall be minimum 2.0. The position of lifting lugs and reference dimension shall be shown on GA and/or outline drawings. NDT shall be conducted for lifting lugs. When any spreader bars are required for lifting and laydown, the bidder shall provide spreader bar with equipment.
14.	Skid Mount/Transportation: Equipment shall be fabricated as skid mount design to the extent practical to minimize erection at the site.
15.	Two pieces of stainless steel earth lugs shall be provided with equipment diagonally. The



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S.No	Description
	position of earth lugs shall be shown on each GA and/or outline drawing.
16.	Provide double nuts for anchor bolts
17.	Bidder shall indicate allowable vibration level on foundation in foundation drawings and general arrangement drawings.
18.	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.
19.	Bidder shall provide the counter flanges with the necessary gaskets and fasteners fitted in.
20.	All the surfaces of the carbon steel should be applied with a rust preventive prior to shipment considering storage period of at least 12 months.
21.	Bidder to provide capacity of crane or hoist required for material handling and the details of heaviest component to be handled.
22.	The list of all Bought out items with makes and country of origin shall be mentioned along with offer to be submitted
23.	Quality Plan shall be submitted along with the offer.
24.	Providing shim plates for erection of equipment / item at site shall be in the scope of bidder.
25.	During detail engineering, bidder to strictly adhere to BHEL/NTPC drawing formats, document numbering, quality plan & FQP formats
26.	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.
27.	Complete detail engineering drawings, calculations, selection of components etc. shall be reviewed & subject to approval of BHEL/NTPC during detail engineering
28.	Bidder shall furnish necessary inputs & drawings of all equipment in editable Auto CAD/ MS-Word /Excel format.
29.	During detail engineering, successful bidder shall ensure flow of drawings/documents as per schedule. Comments from BHEL/NTPC shall be addressed suitably by the bidder.
30.	While every effort is made to specify the requirements of the slurry recirculation pumps, omission of any component / entity essential for the equipment, if observed, shall be duly informed to BHEL & indicated in the Technical / Commercial offer. Supply of the same shall be ensured. In the event the requirement of the component / entity is noticed at a later stage Bidder shall ensure Supply without any cost implication to BHEL.
31.	Bidder shall submit the signed and stamped copy of all the pages which constitutes this technical enquiry specification signed by authorized signatory and clearly mentioning each clause under following two categories to avoid any ambiguity in scope understanding & the scope division along with technical offer.



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BONGAIGAON (3X250 MW)

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S.No	Description
	a. "Accepted without deviation and considered in scope of work" b. "Not considered in scope of work"
8.0	PACKING AND FORWARDING
	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. The packing material has to withstand the conditions for storage in the outside yard for a minimum period of 12 months. 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.
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 Two visits 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 two visits per boiler and totally, there will be 6 visits for 3 boilers. The bidder will be informed well in advance for the visit. Bidder shall include 15 working days at Site per visit in the offer with minimum 6 visits. Travel duration shall be additional.
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



**TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
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S.No	Description
11.0	INSPECTION AND TESTING -
A)	Minimum Testing requirements to be considered are as below: Quality Plan shall be submitted for approval by BHEL .
1.	Hydrostatic test shall 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 shall 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.
7.	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.
8.	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.
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.



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S.No	Description
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 12 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 BHEL 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 monitoring shall be carried out during entire duration of shop running/performance tests. Data shall be recorded
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.
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 on Overseas Vendor (supplies from outside India), Vendor shall engage and appoint at their cost a reputed Third Party Inspection Agency of international presence for carrying out inspection



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S.No	Description
	of equipment's and material at vendor's & sub vendors works.
12.0	PAINTING –
	Bidder shall submit the painting scheme during detail Engineering in line with the specification and shall be subject to approval of BHEL / NTPC. Please see Annexure- IX for Painting.
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 until 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.
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 12 months after placement of purchase Order for the main equipment.
13.3	MANDATORY SPARES:
	Bidder to quote for below mentioned Mandatory spares with break up price. (As per Annexure-X) Mandatory spare parts items shall be handed over separately and shall not be mixed with the supply of the main equipment parts. Spares shall be sent in pre-decided lots in containers/secure boxes. All boxes/containers are to be distinctly marked in red color with boldly written "S" mark on each face of the containers. Spares shall not be dispatched before dispatch of corresponding main equipment's. Each item shall be labelled in English and be packed against damage and sealed to prevent deterioration from corrosion. All spares supplied under this contract shall be strictly inter-changeable with the parts for which they are intended for replacements. All the Initial spares shall be manufactures along with the main equipment components as a continuous operation as per same specification and quality plan. Any special tools & tackles required for the entire equipment to disassemble, assemble or