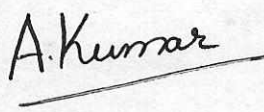
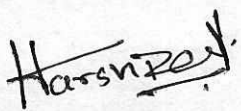
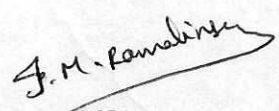

Technical Specification ROS: 9070 Rev 01

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	 Abhinav Kumar Dy. Mgr.-WS	 Harsh Dep Dy. Mgr.-WS	 IMRL Rao Sr. Mgr. -WS
ROS : 9070 Rev01; Dated : 08/01/2021		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. 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)

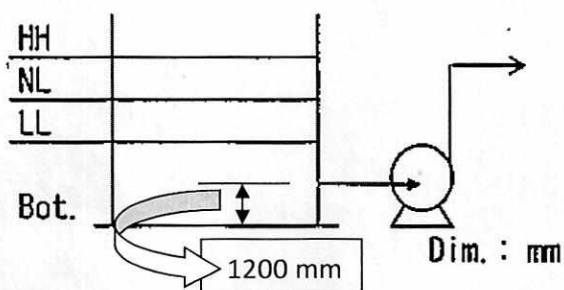


TECHNICAL SPECIFICATION OF RECIRCULATION PUMP BONGAIGAON (3X250 MW)

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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.	Carbionates 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 applicable
	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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6.1	TECHNICAL REQUIREMENTS		
1.	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.		
2.	The Absorber Recirculation Pumps shall circulate the scrubbing liquid from the absorber sump to the spray nozzles in the absorber.		
3.	The Pumps shall be wear resistant & equipped with flushing devices to prevent sedimentation. Shall be designed and installed in a manner to allow easy replacement, repair and maintenance.		
4.	The recirculation pumps shall be equipped with oil level indication, coupling guard & means of collecting leakage automatically & drain out immediately. MOC of collection tray shall be resistant to Slurry corrosion.		
5.	Mechanical Seals with a provision for flushing shall be provided.		
6.	Pump is directly coupled to the Drive Motor at both pump side & motor side end or motor with gear. (Coupling shall be provided by Vendor)		
7.	All the pump wear parts in contact with the slurry shall be provided with replaceable liners suitable for the fluid handled. The Bidder may also offer a SiC lined pump based on previous experience for similar applications. The material used by contractor shall meet Proveness criteria indicated in the specification on previous installations. Silicon Carbide Impeller and Silicon Carbide lined casing also be accepted in similar lines.		
8.	The pump shall be provided with seals of proven type and shall be designed for minimized seal water consumption. The shaft shall be supported on heavy-duty ball/roller bearings.		
9.	All pumps casings shall be designed to withstand a test pressure of 1.5 times the maximum possible pump shut off pressure under maximum suction pressure conditions		
10.	Product water flushing lines and drains shall be supplied for each pump handling the prevailing water to avoid corrosion if the pump is out of operation for extended periods.		
11.	Pumps shall be carefully set to ensure that the net positive suction head available under all operating conditions will be adequate. The NPSH Values shall 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.		
12.	The Pump shall be capable of developing the required total head at rated capacity for continuous operation. The pumps shall also be capable of operation providing 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 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.		
13.	Pumps shall run smoothly with vibration levels as given below during operation. (Peak to peak)		
	Speed	Antifriction Bearing	Sleeve Bearing
	1500 rpm and below	75.0 micron	75.0 micron
	3000 rpm	50.0 micron	65.0 micron



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	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)
14.	The pumps shall be capable of starting with discharge valve fully open and closed condition. Motor drawing & technical datasheet shall furnished to the successful. Bidder after ordering and provision of required data. The bidder to match the existing foundation on one side and the Pump-Motor unit on other face shall provide base plate/Raft. Bidder shall match the interface details and share the outline & GAD drawing for review. 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)
15.	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.
16.	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
17.	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).
18.	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".
19.	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.
20.	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.
21.	In case rubber or nonmetallic linings are used, same shall be two piece molded under pressure and adjusted to the screwed metallic clamping welded to the casting.
22.	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.
23.	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.
24.	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.
25.	The sealing areas shall be designed in such a way so that solids do not precipitate, affect the



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	cooling, or affect adjustment and mechanical functioning of the seals. Seals requiring jet cleaning shall be avoided.																																													
26.	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).																																													
27.	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>Si-SiC</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	Si-SiC
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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.																																													
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.																																													



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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 tip speed shall be within vendor's experience. And Impeller shall have air bleed holes to eliminate any air accumulation around the shaft seal
b.	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
D)	SHAFT AND SHAFT SLEEVE



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	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. 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 & Motor to the existing Foundation. The foundation drawing is enclosed as Annexure-XI 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" 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



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	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 to indicate/Provide 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)					



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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 dBA 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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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



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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.	Each pump shall be put on operation to determine Charactersitic Curves with reference to rated parameter and Flow Mechanical running & general performance test shall be conducted by vendor & witnessed by buyer.
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 pockets & 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 applied 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 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



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S.No	Description
	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:
	Special tools & tackles required for the entire equipment to disassemble, assemble or maintain the units, shall be included in the quotation and furnished as part of the initial supply of the machine. Bidder as per his proven practice shall decide list of special tools & tackles. When special tools are provided, they shall be packed in separate boxes with lifting lugs and marked as "Special Tools for (tag / item number)." Each tool shall be stamped or tagged to indicate its intended usage. Levers and eyebolts 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 the approved procedure in line with 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) All the wear parts of the pump shall be guaranteed for a minimum wear life of not less than 14000 hrs. 4) Noise level-≤ 85 dB (A) at 1m horizontal distance from equipment/enclosures and 1.5m above operating floor is to be guaranteed. 5) Vibration levels measured on the non-rotating parts shall not exceed the zone limit "B" as defined in ISO 10816 at steady conditions and shall not exceed the zone limit "C" as defined in ISO 10816 at transient conditions. 6) Acceptance tests to be carried out as per the procedure defined by the bidder that shall be submitted for BHEL/ NTPC approval. 7) 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.



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S.No	Description
15.0	BID EVALUATION CRITERIA FOR POWER CONSUMPTION:
1.	POWER GUARANTEE :- Bidder to specify the guaranteed Shaft power per Pump operating at the duty point in their offer.(i.e. the guaranteed power consumption-GPC)
2.	BID EVALUATION CRITERIA FOR POWER CONSUMPTION: Power consumption quoted by bidder shall be as minimum as possible. Base value for Shaft power for the designated Recirculation pump= Lowest value of the GPC offered by the bidders In case, Guaranteed Shaft power offered by the bidder exceeds the base value, his bid price will be loaded for excess power consumption as per the formula given below. Adjustment factor for excess power consumption in USD = $(GPC-BV) \times PL \times 12$ No's of Working pumps. GPC- Guaranteed Shaft Power Consumption quoted by bidder in KW per pump BV- Base Value for Shaft Power Consumption PL- Power Loading @ USD 3272 /KW (Exchange rate on the date of bid opening will be considered for evaluation)
16.0	LIQUIDATED DAMAGES FOR POWER CONSUMPTION
	If actual shaft Power Consumption during prove out (or) PG Test operating at the duty point exceeds the value guaranteed by the bidder, liquidated damages for shortfall in performance shall be deducted from contract price as per the formula given below Liquidated damage deductible in INR per pump = $(APC-GPC) \times P \times 12$ No of working pumps. Where, • GPC- Guaranteed Shaft Power Consumption quoted by bidder in KW per pump • APC- Actual Shaft Power Consumption in KW • P- Penalty @ USD – 3272 /KW
17.0	WARRANTY/DEFECT LIABILITY
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



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S.No	Description
	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 .
18.0	FIRST FILL OF CONSUMABLES:
1.	Bidder's scope shall include supply and filling of all lubricants, grease, and filters if applicable 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.
2.	Detailed specifications for the lubricating oil, grease, gases, servo fluids, control fluids, including item qualities and quantities required per month of the plant operation for the NTPC/BHEL's approval herein shall be furnished within 2 months' of placement of Order. On completion of erection complete list of bearings/equipment giving their location and identification marks shall be furnished to BHEL along with lubrication requirements. All types of consumables, lubricants and grease shall be readily obtainable locally and the number of different types shall be kept to a minimum. For each type and grade of lubricant recommended, bidder shall list at least three equivalent lubricants manufactured by alternative companies.
19.0	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.
20.0	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 BHEL in writing of any conflicts between the specifications and Bidder's design, including performance and levels of quality. Bidder agrees that its obligations, liabilities and warranties shall not be diminished or extinguished due to its meeting the requirements of the Specification.



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S.No	Description
21.0	DOCUMENTATION
A	DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER
	The Bidder shall submit all documents, drawings, diagrams and all such information, which are necessary to fully understand the offer for techno – commercial evaluation. As a minimum requirement, the following information shall be furnished to fully describe the scope of work and services offered. Duly filled-in Technical Data sheets (Annexure II) and guarantee schedule furnished under Annexure-III. a. PID diagram b. Performance curve c. Terminal point details. d. GA drgs indicating dimensional data with civil loads and pocket details. e. Rotor GD₂ (kg-m²) f. Torque Vs Speed curve g. Calculation of Motor rating, Bearing capacity and selection of coupling h. Bill of material along with material and code i. Overall space and headroom requirement with details of handling during Erection, operation & maintenance of the equipment. j. Erection, Operation & Maintenance manual with lubrication schedule k. Procedure for shop / site performance tests l. Time schedule for delivery. m. Quality Assurance Plan. n. Make of all bought out items. o. Deviation list p. Spares list q. Hoist / Crane requirement. r. Reference list of similar projects executed. s. List of proposed makes and vendors t. Training program and schedule for BHEL/ NTPC Personnel



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S.No	Description
	u. Equipment maintenance schedules The above documents are required for proper evaluation purpose and vendors are requested to comply with above in all respect.
B	DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT The Successful bidder shall submit necessary data, documents and drawings for review, approval with requirements specified under Annexure-V. However, as minimum the following shall be Submitted. a. Duly filled technical datasheet. b. Warranted performance curves. c. General arrangement drawings indicating dimension and civil loading details. d. Foundation Drawing . e. Motor Data f. Recommended repair procedure etc. g. Operation and maintenance manuals h. Any unique installation instructions shall be noted on the submitted drawings or be provided as a separate document prior to the submission of the Operation and Maintenance Manual. i. Erection schedule and component list. j. Successful Bidder shall submit Calculation for HT Motor power requirement for sizing HT Motor within 2 weeks from the date of ordering. k. The characteristic curves of Recirculation pumps shall be provided along with the documents. These shall be identical and uniform for all the pumps. The pumps shall be designed for optimum power consumption and should not fall under surge point between the operating range. l. The following characteristic curves of the pump shall be submitted: i. Flow v/s Head ii. Flow v/s NPSH iii. Flow v/s Efficiency iv. Flow v/s power consumption v. Torque vs. speed curve for Motor selection The system-resistance Point at different loads shall be indicated in the above performance curves.



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S.No	Description
	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. Bidder in soft and hard copy forms must furnish all necessary GA drawings, sections, sub-assembly drawings, specifications of main, sub components, and necessary set of operation & maintenance manual as asked by NTPC. 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, and 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.



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22.0 ANNEXURES

ANNEXURE-I (PROVENNESS CRITERIA)

QUALIFYING REQUIREMENTS FOR EQUIPMENTS/SYSTEMS

Bidder should have previous experience of manufacturing and supplying of Slurry Recirculation Pumps for the Wet limestone based FGD system of the type, applicable and min pump rating as stipulated below such that the its pump should have been in successful operation in at least one plant for a period is not less than one year as per Techno-Comm BID.

Type and Rating for Qualification (Bidder shall refer the document enclosed).

Name of Equipment	Type of Equipment	Application	Equipment Rating
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 as Minimum.

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

Bidder to furnish end-user performance Certificate to meet the above qualification requirement.

SIGNATURE OF BIDDER _____

NAME _____

DESIGNATION _____



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ANNEXURE – II- TECHNICAL DATA SHEET

Sl. No	Description	Data
1.0	GENERAL	
	a. Client	: BHEL-Ranipet
	b. Project	: Bongaigaon 3X250MW
	c. Ultimate Customer	: NTPC
	d. Location	: Bongaigaon, Kokrajhar, Assam, India
	e. Service	: Continuous
	f. Installation	: Inside steel structure shed with roof side sheeting
	g. No of pumps for each unit	: 3W + 1S
	h. Total number of pumps for all units	: 12 No's
2.0	MANUFACTURER DETAILS	
	a. Model	: Bidder to provide
	b. Type	: Centrifugal
	c. Type of Driver	:
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
	Concentration of chloride	: <25,000 ppm (Max)
	Vapor Pressure at Pump	: 0.196 kg/cm ²
	Viscosity of slurry	: 0.01 Pa. s
	Concentration of slurry	: 30(% by weight)
	Specific gravity of slurry	: 1.202@design and 1.201@ guarantee point
	pH of slurry	: 4-8
	Slurry Temperature	: 59.2 deg.C (normal) & 70 deg.C (max)
4.0	PERFORMANCE DATA	
	a. Capacity m ³ /hr	: 10100
	b. Head M	: 16.7 Liquid Column
	c. Pump efficiency (Not Less Than 87%)	: Bidder to specify efficiency
	d. BkW Normal / Maximum KW	: Bidder to specify
	e. Motor rating KW	: Bidder to specify
	f. Motor Speed Rpm	: Bidder to specify
	g. Differential pressure (inclusive of losses) Kg/cm ²	: Bidder to specify
	h. Speed Maximum/ Normal/Minimum rpm	: Bidder to specify (Max check any max limit)
	i. Noise level <85 dB(A)	: Bidder to specify noise level.
	j. Performance curve	: Bidder to Provide



TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BONGAIGAON (3X250 MW)

BONGAIGAON:WS:ARP: ROS 9070 Rev 01

4.0	CONSTRUCTION DATA		
	a. Make	:	Bidder to specify
	b. Model No.	:	Bidder to specify
	c. Suction Rating / Size	:	Bidder to specify
	d. Discharge Rating / Size	:	Bidder to specify
	e. Type of rotor	:	Bidder to specify
	f. Size of rotor Dia mm	:	Bidder to specify
	g. Journal bearing: Type / Size:	:	Bidder to specify
	h. Thrust bearing: Type / Size:	:	Bidder to specify
	i. Bearing cooling required	:	Yes / No - Bidder to specify.
	j. Cooling water required qty	:	Bidder to specify the quantity
	k. Type of drive with gear box	:	Bidder to furnish details
	l. Shaft seal – Mech seal.	:	Bidder to confirm and specify make.
	m. Size / Code	:	Bidder to specify
	n. Type of coupling	:	Bidder to furnish details
	o. Service factor	:	Bidder to specify
	p. GD ² at drive shaft end	:	Bidder to specify
	q. Rotation viewed from coupling end	:	Clock wise / Counter clock wise
	r. Coupling type-flexible	:	Bidder to confirm and furnish details.
	s. Coupling make	:	Bidder to specify
	t. Base plate common to pump, bearing housing, coupling	:	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 specify
	b. Impeller	:	Bidder to specify
	c. Shaft	:	Bidder to specify
	d. Shaft Seal	:	Bidder to specify
	e. Base frame	:	Bidder to specify

SIGNATURE OF BIDDER

NAME

DESIGNATION



TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BONGAIGAON (3X250 MW)

BONGAIGAON:WS:ARP: ROS 9070 Rev 01

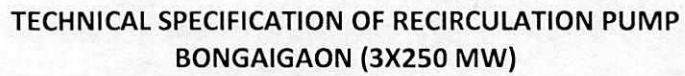
ANNEXURE III- SCHEDULE OF GUARANTEES

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 in all directions 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 -----



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

[illegible]

SIGNATURE OF BIDDER _____

NAME _____

DESIGNATION -----



TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BONGAIGAON (3X250 MW)

BONGAIGAON:WS:ARP: ROS 9070 Rev 01

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



TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BONGAIGAON (3X250 MW)

BONGAIGAON:WS:ARP: ROS 9070 Rev 01

B) DOCUMENTS TO BE SUBMITTED AFTER CONTRACT:

Sl. No.	Description	No of copies After award of contract	Delivery Time
1.	Utility Consumption	1	2 weeks after contract
2.	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



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

BONGAIGAON:WS:ARP: ROS 9070 Rev 01

Sl. No.	Description	No of copies After award of contract	Delivery Time
24.	Operation and Maintenance Manual	• 10 hardcopies and 5 electronic copies in English	4 months after contract
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 _____



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

BONGAIGAON:WS:ARP: ROS 9070 Rev 01

ANNEXURE-VI

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

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

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----



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

BONGAIGAON:WS:ARP: ROS 9070 Rev 01

ANNEXURE-VII

INSPECTION & TESTING

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

SIGNATURE OF BIDDER _____

NAME _____

DESIGNATION _____



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

BONGAIGAON:WS:ARP: ROS 9070 Rev 01

ANNEXURE-VIII

Instruments Specification

Refer to instruments specification enclosed.

SIGNATURE OF BIDDER _____

NAME _____

DESIGNATION _____



TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BONGAIGAON (3X250 MW)

BONGAIGAON:WS:ARP: ROS 9070 Rev 01

ANNEXURE-IX

Painting Scheme

Service Condition : Exposed to atmosphere

Surface Preparation : Power Tool Cleaning to St3 (SSPC-SP3)

Coating Procedure :

SI No.	Coat	Paint	No. of Coats / DFT	Shade	Total DFT μm (min)
1.	Primer coat	Zinc phosphate Primer	2 Coat/DFT= 30 μm per coat	--	100 Microns
2.	Intermediate Coat	--	--	--	
3.	Finish coat	2K Epoxy paint or equivalent / DFT= 20 μm per coat --	2	RAL 5015	

Colour Code : Shade RAL5015

Note:-

- The above painting schedule is tentative. Painting shall be carried out as per end customer approved painting schedule, which will be informed during the contract stage.
- Corrosion protection, coating and galvanizing, painting shall be taken care by the bidder.
- Rust preventive paint after inspection at shop floor before dispatch shall be in bidder's scope.

SIGNATURE OF BIDDER _____

NAME _____

DESIGNATION _____



TECHNICAL SPECIFICATION OF RECIRCULATION PUMP
BONGAIGAON (3X250 MW)

BONGAIGAON:WS:ARP: ROS 9070 Rev 01

ANNEXURE-X: List of Mandatory Spares

Sl. No.	Description	Quantity
1.	Impeller Assembly	3 no. of each type
2.	Casing Liners (where replaceable liners are provided)	1 no. of each type
3.	Complete Casing	1 no. of each type
4.	Seals	3 no. of each type
5.	Bearings	1 no. of each type
6.	Motor-Pump Coupling	1 no. of each type

SIGNATURE OF BIDDER _____

NAME _____

DESIGNATION _____

SL.		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				
			HARDNESS TESTING	MAJOR	HARDNESS TEST	100%		DIN 1.4571	DIN 1.4571	INSPECTION REPORT	✓	P	V	V
2.5	ROTATING PARTS	BALANCING	DO	STATIC & DYNAMIC BALANCING	100 %	100 %	100 %	ISO 1940 GRADE 2.5	ISO 1940 GRADE 2.5	INSPECTION REPORT	✓	P	V	V
3.	FINAL INSPECTION													
3.1	PUMP CASING	WATER PRESSURE (STATIC) TESTING	MAJOR	HYDRAULIC TEST	100%	100%	NTPC APP. DRAWING & DATA SHEET	NTPC APP. DRAWING & DATA SHEET	INSPECTION REPORT & PROTOCOL	✓	P	V	V	SEE NOTE 1
3.2	PERFORMANCE TESTING OF PUMP	FLOW, HEAD, EFFICIENCY, BHP NOISE, VIBRATION ETC. AT RATED SPEED		MEASUREMENT	100%	3/1 NOS	NTPC APPROVED DRAWING & DATA SHEET	NTPC APPROVED DRAWING, DATA SHEET, PROCEDURE, SPECIFICATION, QSA 004 / DIN EN ISO 9906-1	INSPECTION REPORT & PROTOCOL	✓	P	W	W	
3.3	STRIP TEST IN CASE OF DOUBT TO ABNORMAL SOUND	UNDUE WEAR	MAJOR	VISUAL	100%	3/1 NOS	NTPC APPROVED DRAWING, SPECIFICATION	NTPC APPROVED DRAWING, SPECIFICATION	INSPECTION REPORT & PROTOCOL		P	W	W / V	\$ 100 % SEE NOTE 2

DÜCHTING PUMPEN
 Maschinenfabrik GmbH & Co KG
 Wilhelm-Düchting-Str. 22
 58453 Witten - Annen

MANUFACTURER/SUB-SUPPLIER		MAIN-SUPPLIER	SIGNATURE	LEGEND: * D RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER (BHEL/DUCON), N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION, AS APPROPRIATE, R: REVIEW OF CERTIFICATE/RECORD MTC: MATERIAL TEST CERTIFICATE WPS: WELDING PROCEDURE SPECIFICATION WPQ: WELDING PROCEDURE QUALIFICATION CHP: NTPC SHALL IDENTIFIED IN COLUMN "N" AS "W" SR: STRESS RELIEVING	FOR NTPC USE	DOC. NO.:	REV..... CAT.....	
						REVIEWED BY	APPROVED BY	APPROVAL SEAL

Gailan
 (for Ducun)

	MANUFACTURER'S NAME AND ADDRESS: DUECHTING PUMPEN MASCHINENFABRIK GMBH & CO KG WILHELM-DUECHTING-STR-22 58453 WITTEN, GERMANY		MANUFACTURING QUALITY PLAN				PROJECT: FGD FOR BONGAIGON 3 X 250 MW PACKAGE : SG PACKAGE WITH ESP CONTRACT NO: CS-4610-101-2 MAIN-SUPPLIER: DUCON TECH. INC			
			ITEM : SLURRY RECIRCULATION PUMP SUB-SYSTEM: FGD System		QP NO. : DCI09-5038-MQP-003 REV.NO. : 01 DATE: 21 JULY 2010 PAGE 3 OF 5					

SL.	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.	D	**	10.	11.
2.2	SHAFT	NDT	MAJOR	ULTRASONIC TEST	100 %	100 %	NTPC APP. DRAWING & SPEC.	SEP 1920-1 gr.3	UT REPORT	✓	P	V	V
		NDT	MAJOR	DYE PENETRANT TESTING	100%	100%	APP.DRAWING	DIN 1690-2	DPT REPORT	✓	P	V	V
2.3	IMPELLER HUB	DIMENSION	MAJOR	MEASUREMENT	100%	100%	NTPC APPROVED DRAWING	NTPC APP. DRAWING,	INSPECTION REPORT	✓	P	V	V
		NDT	MAJOR	DYE PENETRATION TEST	100%	100%	DIN EN 571-1 / DIN 1690-2 (QUALITY GRADE 4)	DIN EN 571-1 / DIN 1690-2 (QUALITY GRADE 4)	NDT REPORT	✓	P	V	V
2.4	SHAFT SLEVE	DIMENSION	MAJOR	MEASUREMENT	100%	100%	NTPC APPD. DRAWING	NTPC APPD. DRAWING,	INSPECTION REPORT	✓	P	V	V
		NDT	MAJOR	DYE PENETRATION TEST	100%	100%	DIN EN 571-1 / DIN1690-2	DIN EN 571-1 / DIN1690-2	NDT REPORT	✓	P	V	V


 Maschinenfabrik GmbH & Co KG
 Wilhelm-Duechting-Str. 22
 58453 Witten - Annen

MANUFACTURER/SUB-SUPPLIER SIGNATURE		LEGEND: * D RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER (BHEL/DUCON), N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION, AS APPROPRIATE, R: REVIEW OF CERTIFICATE/RECORD MTC: MATERIAL TEST CERTIFICATE WPS: WELDING PROCEDURE SPECIFICATION WPQ: WELDING PROCEDURE QUALIFICATION CHP: NTPC SHALL IDENTIFIED IN COLUMN "N" AS "W" SR: STRESS RELIEVING	FOR NTPC USE	DOC. NO.: _____ REV..... CAT.....	
				REVIEWED BY _____	APPROVED BY _____

Gailay
 11/01/10
 (for Ducor)

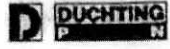
SL.		COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
						M	C/N				M	C	N	
1	2	3	4	5	6	7	8	9	10	11				
1.2	IMPELLER & WEAR PLATE	REVIEW OF TC FOR CHEMICAL & MECHANICAL PROPERTIES	MAJOR	CHEMICAL COMPOSITION	PER HEAT	PER HEAT	NTPC APPROVED DRAWING & DATA SHEET	NTPC APPROVED DRAWING & DATA SHEET	MTC	✓	P	V	V	
			DO	BENDING, TENSILE STRENGTH, BRITTLE TEMPERATURE	DO	DO	DO	DO	MTC	✓	P	V	V	
1.3	IMPELLER HUB, SHAFT SLEEVE, SHAFT	REVIEW OF TC FOR CHEMICAL PROPERTIES	DO	CHEMICAL COMPOSITION	DO	DO	DO	DO	MTC	✓	P	V	V	
2	IN- PROCESS INSPECTION													
2.1	IMPELLER	WORKMANSHIP & DIMENSION	MAJOR	VISUAL & MEASUREMENT	100%	100%	NTPC APPROVED DRAWING	NTPC APPROVED DRAWING	INSPECTION REPORT	✓	P	V	V	
		NDT	DO	PENETRANT TEST	100%	100%	DIN EN 571-1 / DIN1690-2 (QUALITY GRADE 4)	DIN EN 571-1 / DIN1690-2 (QUALITY GRADE 4)	NDT REPORT	✓	P	V	V	

DÜCHTING PUMPEN
Maschinenfabrik GmbH & Co KG
Wilhelm-Düchting-Str. 22
58453 Witten, Germany

MANUFACTURER/SUB-SUPPLIER		MAIN-SUPPLIER		LEGEND: * D RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER (BHEL/DUCON), N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION, AS APPROPRIATE. R: REVIEW OF CERTIFICATE/RECORD MTC: MATERIAL TEST CERTIFICATE WPS: WELDING PROCEDURE SPECIFICATION WPO: WELDING PROCEDURE QUALIFICATION CWP: NTPC SHALL IDENTIFIED IN COLUMN "N" AS "W" SR: STRESS RELIEVING	FOR NTPC USE	DOC. NO.:		REV..... CAT.....	
SIGNATURE									
						REVIEWED BY		APPROVED BY	

Failay
4/2016
(for DUCON)

Annexure-VII (Inspection & Testing)

 MANUFACTURER'S NAME AND ADDRESS : DUECHTING PUMPEN MASCHINENFABRIK GMBH & CO KG WILHELM-DUECHTING-STR-22 58453 WITTEN, GERMANY		MANUFACTURING QUALITY PLAN						PROJECT: FGD FOR BONGAIGON 3 X 250 MW PACKAGE : SG PACKAGE WITH ESP CONTRACT NO: CS-4610-101-2 MAIN-SUPPLIER: DUCON TECH. INC						
		ITEM : SLURRY RECIRCULATION PUMP SUB-SYSTEM: FGD System			QP NO. : DCI09-5038-MQP-003 REV.NO. : 01 DATE: 21 JULY 2010 PAGE - 1 OF 5									
SL.	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.	D	**	10.	11.	
1	RAW MATERIAL													
1.1	VOLUTE CASING, CASING COVER	REVIEW OF TC FOR CHEMICAL	MAJOR	CHEMICAL COMPOSITION	PER HEAT	PER HEAT	NTPC APPROVED DRAWING, DATA SHEET & SPECIFICATION	NTPC APPROVED DRAWING, DATA SHEET & SPECIFICATION	MTC	✓	P	V	V	
		MECHANICAL PROPERTIES	DO	TENSILE TEST	PER HEAT	PER HEAT	DO	DO	MTC	✓	P	V	V	
		REVIEW OF TC FOR VISUAL & DIMENSIONAL	MAJOR	WORKMANSHIP & MEASUREMENT	100%	100%	NTPC APPROVED DRAWING	NTPC APPROVED DRAWING	INSPECTION REPORT	✓	P	V		
		REVIEW OF NDT REPORT	MAJOR	UT (I)	100%	100%	NTPC APPROVED DRAWING, DATA SHEET, EN 12680-3	NTPC APPROVED DRAWING, DATA SHEET, EN 12680-3	UT REPORT	✓	P	V	V	

Digitally signed
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DUECHTING PUMPEN
 Maschinenfabrik GmbH & Co KG
 Wilhelm-Duechting-Str. 22
 58453 Witten - Anpen

Paikay
 11/08/10
 (for DUCON)

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MANUFACTURER/ SUB-SUPPLIER SIGNATURE	MAIN-SUPPLIER		REVIEWED BY	APPROVED BY	APPR OVAL SEAL	

		MANUFACTURER'S NAME AND ADDRESS: DUECHTING PUMPEN MASCHINENFABRIK GMBH & CO KG WILHELM-DUECHTING-STR-22 58453 WITTEN, GERMANY		MANUFACTURING QUALITY PLAN ITEM : SLURRY RECIRCULATION PUMP SUB-SYSTEM: FGD System				QP NO. : DCI09-5038-MQP-003 REV.NO. : 01 DATE: 21 JULY 2010 PAGE 5 OF 5		PROJECT: FGD FOR BONGAIGON 3 X 250 MW PACKAGE : SG PACKAGE WITH ESP CONTRACT NO: CS-4610-101-2 MAIN-SUPPLIER: DUCON TECH. INC			
SL.	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	D	**	10	11
3.4	PUMP COATING	COMPLIANCE TO PAINTING SPECIFICATION	MAJOR	DRY FILM THICKNESS / COLOUR	SPOT CHECK	SPOT CHECK	NTPC APPROVED PAINTING PROCEDURE / SCHEME	NTPC APPROVED PAINTING PROCEDURE / SCHEME	INSPECTION REPORT & PROTOCOL	✓	P	V	
3.5	CHECK OF QUALITY ASSURANCE DOCUMENTATION	COMPLIANCE TO MQP	MAJOR	COMPLETENESS OF CHECKS	100%	100%	MQP	MQP	PROTOCOL	✓	P	W	V

NOTE 1 : THE PUMP CASING SHALL BE HYDRAULICALLY TESTED AT 200 % OF PUMP RATED HEAD OR AT 150 % OF SHUT OFF HEAD, WHICH EVER IS HIGHER. THE TEST PRESSURE SHALL BE MAINTAINED FOR AT LEAST HALF AN HOUR

NOTE 2 : IN ANY CASE, 3 NOS. BY MAIN SUPPLIER AND 1 NO. BY NTPC SHALL BE WITNESSED

NOTE 3 : INSPECTION CALLS FOR NTPC WITNESS POINTS SHALL BE RAISED 2 MONTHS IN ADVANCE

DUECHTING PUMPEN
 Maschinenfabrik GmbH & Co KG
 Wilhelm-Duechting-Str. 22
 58453 Witten-Annen

MANUFACTURER/SUB-SUPPLIER SIGNATURE		MAIN-SUPPLIER SIGNATURE	LEGEND: * D RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: MANUFACTURER/SUB-SUPPLIER C: MAIN SUPPLIER (BHEL/DUCON), N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION AS APPROPRIATE, R: REVIEW OF CERTIFICATE/RECORD MTC: MATERIAL TEST CERTIFICATE WPS: WELDING PROCEDURE SPECIFICATION WPQ: WELDING PROCEDURE QUALIFICATION CHP: NTPC SHALL IDENTIFIED IN COLUMN "N" AS 'W' SR: STRESS RELIEVING	FOR NTPC USE	DOC. NO.: _____ REV..... CAT.....	
					REVIEWED BY	APPROVED BY

Handwritten signature
 (for DUCON)

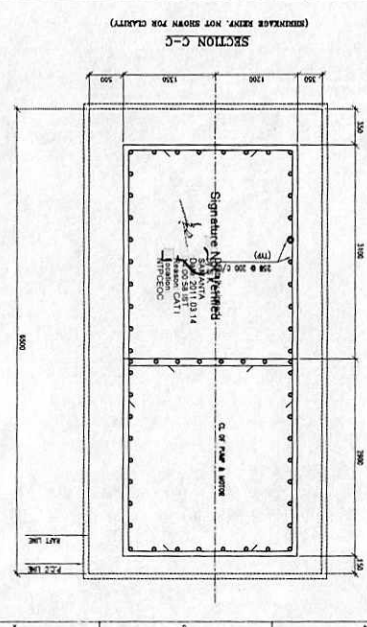
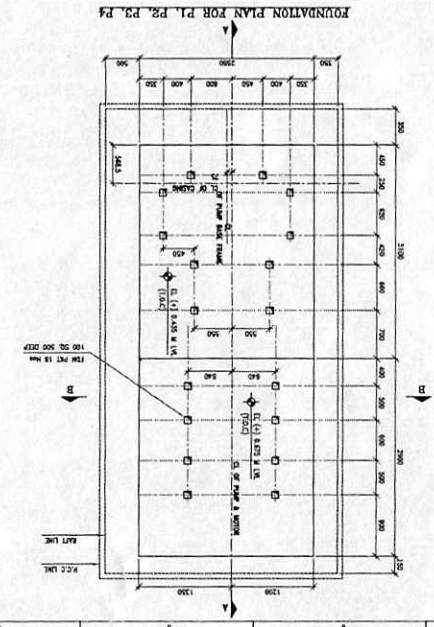
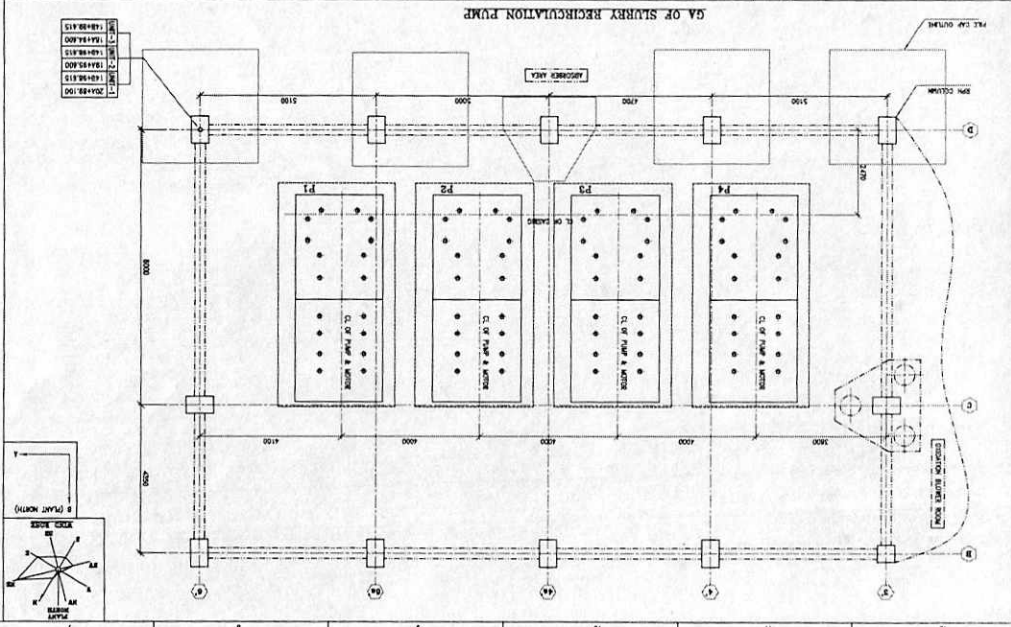
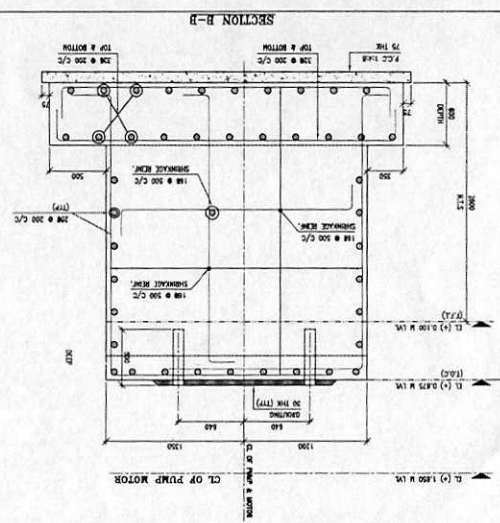
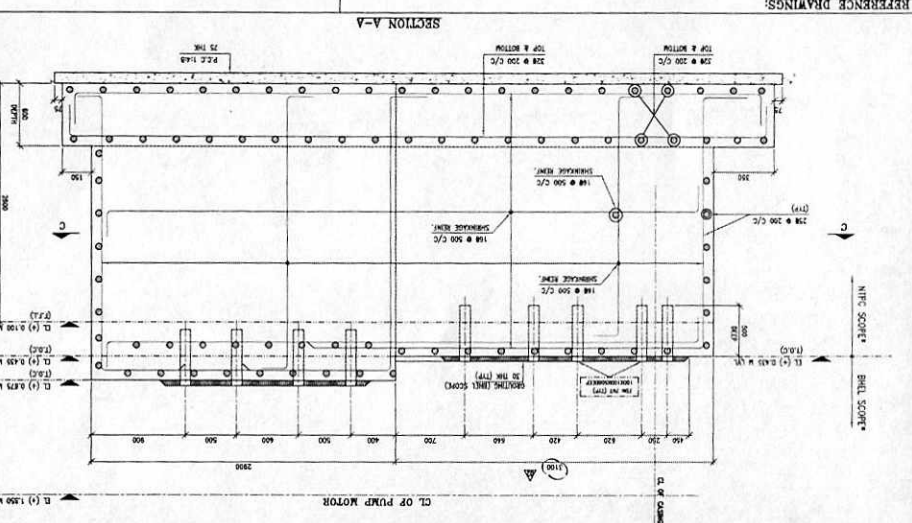
REFERENCE DRAWINGS:

1. 4610-101-03BP-PVC-B-018/008 - LAYOUT OF ASSOCIATED AREA
2. 4610-101-03BP-PVC-B-018/008 - LAYOUT OF ASSOCIATED AREA
3. 4610-101-03BP-PVC-B-018/008 - LAYOUT OF ASSOCIATED AREA
4. 4610-101-03BP-PVC-B-018/008 - LAYOUT OF ASSOCIATED AREA
5. 4610-101-03BP-PVC-B-018/008 - LAYOUT OF ASSOCIATED AREA
6. 4610-101-03BP-PVC-B-018/008 - LAYOUT OF ASSOCIATED AREA
7. 4610-101-03BP-PVC-B-018/008 - LAYOUT OF ASSOCIATED AREA
8. 4610-101-03BP-PVC-B-018/008 - LAYOUT OF ASSOCIATED AREA
9. 4610-101-03BP-PVC-B-018/008 - LAYOUT OF ASSOCIATED AREA
10. 4610-101-03BP-PVC-B-018/008 - LAYOUT OF ASSOCIATED AREA
11. 4610-101-03BP-PVC-B-018/008 - LAYOUT OF ASSOCIATED AREA
12. 4610-101-03BP-PVC-B-018/008 - LAYOUT OF ASSOCIATED AREA
13. 4610-101-03BP-PVC-B-018/008 - LAYOUT OF ASSOCIATED AREA
14. 4610-101-03BP-PVC-B-018/008 - LAYOUT OF ASSOCIATED AREA
15. 4610-101-03BP-PVC-B-018/008 - LAYOUT OF ASSOCIATED AREA
16. 4610-101-03BP-PVC-B-018/008 - LAYOUT OF ASSOCIATED AREA
17. 4610-101-03BP-PVC-B-018/008 - LAYOUT OF ASSOCIATED AREA
18. 4610-101-03BP-PVC-B-018/008 - LAYOUT OF ASSOCIATED AREA
19. 4610-101-03BP-PVC-B-018/008 - LAYOUT OF ASSOCIATED AREA
20. 4610-101-03BP-PVC-B-018/008 - LAYOUT OF ASSOCIATED AREA

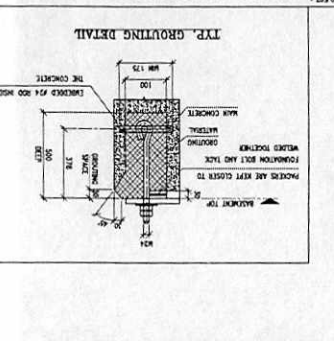
CONSTRUCTION REFERENCE DMS:

1. ALL DIMENSIONS ARE IN METERS UNLESS OTHERWISE SPECIFIED.
2. ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE SPECIFIED.
3. ALL DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED.
4. ALL DIMENSIONS ARE TO SURFACE UNLESS OTHERWISE SPECIFIED.
5. ALL DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED.
6. ALL DIMENSIONS ARE TO SURFACE UNLESS OTHERWISE SPECIFIED.
7. ALL DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED.
8. ALL DIMENSIONS ARE TO SURFACE UNLESS OTHERWISE SPECIFIED.
9. ALL DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED.
10. ALL DIMENSIONS ARE TO SURFACE UNLESS OTHERWISE SPECIFIED.
11. ALL DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED.
12. ALL DIMENSIONS ARE TO SURFACE UNLESS OTHERWISE SPECIFIED.
13. ALL DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED.
14. ALL DIMENSIONS ARE TO SURFACE UNLESS OTHERWISE SPECIFIED.
15. ALL DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED.
16. ALL DIMENSIONS ARE TO SURFACE UNLESS OTHERWISE SPECIFIED.
17. ALL DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED.
18. ALL DIMENSIONS ARE TO SURFACE UNLESS OTHERWISE SPECIFIED.
19. ALL DIMENSIONS ARE TO CENTER UNLESS OTHERWISE SPECIFIED.
20. ALL DIMENSIONS ARE TO SURFACE UNLESS OTHERWISE SPECIFIED.

NOTES:



ANNEXURE-XI



REV	NO.	DESCRIPTION	DATE	BY	CHKD	APPD	DATE
01	1	ISSUED FOR CONSTRUCTION	07/10/2010	RAJ	RAJ	RAJ	07/10/2010
02	2	REVISED AS PER PWD COMMENTS	07/10/2010	RAJ	RAJ	RAJ	07/10/2010

NO.	DESCRIPTION	DATE	BY	CHKD	APPD	DATE
01	ISSUED FOR CONSTRUCTION	07/10/2010	RAJ	RAJ	RAJ	07/10/2010
02	REVISED AS PER PWD COMMENTS	07/10/2010	RAJ	RAJ	RAJ	07/10/2010

NO.	DESCRIPTION	DATE	BY	CHKD	APPD	DATE
01	ISSUED FOR CONSTRUCTION	07/10/2010	RAJ	RAJ	RAJ	07/10/2010
02	REVISED AS PER PWD COMMENTS	07/10/2010	RAJ	RAJ	RAJ	07/10/2010

Bharat Heavy Electricals Limited
Ranipet-632406, India.
Quality Assurance(Mech)

To,

Shri V Raghupathy, Sr.Mgr. /FGD-Purchase

FGD: BONGAIGAON: RC Pump/QA-MECH: 122

Dt. 24-07-2020

INDENT NO:	RFW00832	RFW00836	RFW00837	RFW00899
PGMA	FW212	FW212 <i>spandhi</i>	FW212	FW997
Project Details	BONGAIGAON 3X250 MW (Unit-I, Unit-II, Unit-III)			
ENGG. SPEC.	BONGAIGAON:WS:ARP:ROS9070 Rev.00 DT: 18/07/2020			
Purchase TR:	Bong-G305/G306/G307 DT:18.07.2020			
Item:	Absorber Recirculation Pumps & Accessories			

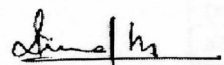
"NTPC has informed that in case of the item covered under Sub-QR list, the proposed vendor s for same item shall be accepted by QA after acceptance of Vendor by NTPC Engg"

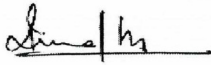
Quality department comments as follows:

1. Inspection and testing shall be done as per approved Quality plan which is to be approved by customer (NTPC)
2. Painting shall be done as per Customer approved Painting scheme.
3. As RC pumps for Bongaigaon project comes under Sub-QR category, hence on receipt of sub-QR clearance from NTPC Engg. by our Engg., same vendor will be accepted by QA also.
4. Arrange MQP from Sub-QR cleared vendor for taking up with NTPC for their approval. The Typical MQP (SQP No. FGS: 723/00 DT:12.02.2019) is already available in the purchase file itself. This MQP is indicative only and actual Quantum of check/Stage may differ based on Project/Customer requirements.
5. All the slurry pumps will be inspected at supplier's work as per Approved QP / Approved drawing/Approved datasheet and specification.
6. Annexure-Q shall be a part of the enquiry file.
7. Vendor shall confirm following for inspection purpose.
 - a. Latest version of standards & Specification shall be applied.
 - b. Materials shall be procured in compliance to Functional Technical Specification.
 - c. Gauges and measuring instruments with valid calibration only shall be used.
 - d. Inspection / Inspection wavier / approval by BHEL does not absolve Supplier's responsibility for conformity of the specification as per the terms of PO.
 - e. BHEL /BHEL Authorized representatives shall have the right to witness the necessary inspection and testing of goods mentioned in the PO.
 - f. In case of Vendor Drawing & Datasheet, it needs approval by BHEL Engineering.
 - g. This QP shall be read along with relevant PO, BHEL Specification / Drawing / Approved Datasheet

Spandhi
24.07.2020
Sanjib Pandit

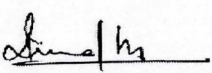
Rakesh Kumar Madhu
24/07/2020

 Ranipet		MANUFACTURER'S NAME AND ADDRESS M/S BHEL: BAP: RANIPET 632 406 TAMIL NADU		STANDARD QUALITY PLAN										
				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
					M	C/N					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	** 10.			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	V	
1.4	Shaft	Chemical Composition	Major	Chemical composition	1 Sample/Heat		Drawing/Specification		Test Report	✓	P	V	V	
		Mechanical Properties		Mechanical Tests			Drawing/Specification		Test Report	✓	P	V	V	
		Hardness Test		Mechanical Hardness	100%		Drawing/Specification		Test Report	✓	P	V	V	
		Internal Soundness		UT	100%		ASTM A 388/	ASME Sec V	UT Report	✓	P	V	V	
		Surface & Sub Surface Defects		MT-on m/c Surface	100%		ASTM E709	ASME Sec V	MT Report	✓	P	V	V	MT-Magnetic Particle Test
1.5	Impeller	Surface & Sub Surface Defects	Major	DPT	Accessible Areas		ISO4987	ASME Sec V	PT Report	✓	P	V	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	-	-	Spot Check by BHEL
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)				

 Ranipet		MANUFACTURER'S NAME AND ADDRESS M/S BHEL: BAP: RANIPET 632 406 TAMIL NADU		STANDARD QUALITY PLAN										
				ITEM: RECIRCULATION PUMP SYSTEM: FGD						QP NO		FGS:723		
										REV. NO:		00		
										DATE:		12.02.2019		
								PAGE NO:		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				D*	M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	** 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	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	√	P	W	W	
		Measurement- Flow vs Head(Complete operating range), Power, Efficiency	Major	Performance testing of pump	100%	*	Approved Drawing /Data Sheet		Performance Test Report	√	P	W	W	
		Vibration Velocity RMS [MM/S] Bearing Temperature Noise		Measurement	100%	*	Approved Drawing. Approved Data Sheet		Performance Test Report	√	P	W	W	
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)				

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*	** 10.			11.
			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	Only Required in case of Abnormal Sound
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 Complements	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)
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