
ANNEXURE A

FOR

WATER PUMPS

OF NTPC PROJECT

CONFIDENTIAL

CUSTOMER	: NTPC
APPLICATION	: FLUE GAS DESULPHURIZATION SYSTEM
PROJECT	: BARH – II 2 x 660 MW



Flue Gas Desulphurization
Air Quality Control Systems
Bharat Heavy Electrical Limited
Ranipet – 632 406.



TECHNICAL SPECIFICATION FOR WATER PUMPS –NTPC Project

NTPC:FGD:WP: BARH-II : ANNEXURE A

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TECHNICAL SPECIFICATION FOR WATER PUMPS –NTPC Project

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1.0 PROJECT INFORMATION:

a.	Owner	NTPC (BARH –II- 2 X 660MW)
b.	Buyer	BHEL, Ranipet
c.	Process/Application	Flue Gas Desulphurization
d.	Site Location	Bihar, Patna

A) SITE CONDITIONS

1.	Ambient Temperature and Relative Humidity		
a.	Average Site Condition ASC		
	Ambient Temperature	:	27 deg C
	Ambient Temperature (Design)	:	45 deg C
	Relative Humidity	:	60 %

A) PROJECT LOCATION AND APPROACH

a	Site Address	BHEL SITE OFFICE BARH-II- 2x660 MW, NATIONAL THERMAL POWER CORPORATION BIHAR,PATNA, INDIA EPC CONTRACTOR: BHARAT HEAVY ELECTRICALS LIMITED, INDIA"
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2.0 PROVENNESS CRITERIA:

Bidder should have previous experience of design, manufacture, supply, erection and commissioning / supervised erection & commissioning of the Water Pumps as per criteria given in table below and the water pump(s) should have been in successful operation for a period not less than One (1) year prior to Part-I (Techno-commercial) bid opening date”

Sl. No.	Name of Equipment	Type of Equipment	Equipment Rating
1	Water Pumps	Centrifugal pump	80% of the flow & 100% of the head of the offered water Pump(s)

The Bidder shall offer only proven design which meets the Proveness criteria indicated above. Necessary documentary evidences as per Annexure-I for qualification shall be submitted along with the bid. If bidder does not meet the specified Provenness criteria, they are denied to participate in this tender.

ANNEXURE – I

a) REFERENCE LIST as per format shown below

S. No.	Project Name , Customer & Plant capacity	Flow	Head	Motor KW	Qty	Year of Commg	Performance Certificate/ Documentary Evidence
1.							to be enclosed
2.							to be enclosed

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----



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3.0 WATER ANALYSIS:

The following water analysis to be considered:

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

4.0 PUMP DETAILS:

Sl.No	Description	Unit	Process water Pumps	Mist eliminator wash & Emergency Quench pumps
1.	Number of pumps	Nos	4	4
2.	Drive Motor		Included in the bidder's scope of supply. The approved vendor list is attached separately (Annexure B)	
3.	Head of the pump	m	45	80



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4.	Capacity of the Pump	m ³ / hr.	190	150
5.	Coupling		Direct drive	Direct drive
6.	Type of Pumps		Horizontal centrifugal	Horizontal centrifugal
7.	Specific Gravity	--	1	1
8.	Viscosity	Pa-s	0.003	0.003
9.	Fluid medium	---	Process water	Process water
10.	Water Characteristics		As per Clause No: 3.0	As per Clause No: 3.0
11.	Mode of operation	--	Continuous	Continuous
12.	Maximum operating temperature	°C	45	45
13.	Maximum operating speed	rpm	1500	1500
14	Service	---	Outdoor. Pump along with motor to be supplied along with canopy.	Outdoor
15	Casing, Gland and stuffing Box		2.5 Ni Cast Iron to IS 210 Grade	
			FG 260 or equivalent.	
16	Impeller (Wear Rings, as applicable)		Stainless Steel-316 grade	
17	Shaft & Sleeves		Stainless Steel-410	
18	Sound (maximum)	dB	85	85
19	Pump Efficiency (min	%	60%(min)	60%(min)



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5.0 PAINTING PROCEDURE

SURFACE PREPARATION: Power Tool Cleaning to St3 (SSPC-SP3)

Primer coat		Intermediate Coat		Finish Coat		Shade	Total DFT μm (min)
Paint	No. of Coats/ DFT	Paint	No. of Coats/ DFT	Paint	No. of Coats		
Red Oxide Zinc Phosphate Primer to IS: 12744	2 coat DFT = 30 μm per coat	Synthetic Enamel intermediate coat to IS 2932	1 coat DFT = 50 μm	Synthetic Enamel coat to IS 2932	2 coat DFT = 50 μm per coat	To be informed latter	210 Microns

6.0	MANDATORY SPARES
	Bidder to quote for below mentioned mandatory spares with break up price : 1. Complete Impeller Assembly - 1 nos for each type & size. 2. Casing Liners- 1 set for each type. 3. Bearings -1 Set 4. Motor- 1 No. of each type Note : Any change in size material design etc. which obviates one to one replacement of the part shall be considered a different type. Unless other wise stated a set shall mean complete replacement for one equipment.
7.0	BID EVALUATION CRITERIA FOR POWER CONSUMPTION:
1.	POWER GUARANTEE: Bidder to specify the guaranteed power consumption at motor input Terminal per Pump operating at the duty point in their offer.



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2.	BID EVALUATION CRITERIA FOR POWER CONSUMPTION: Power loading is applicable for the following Pumps 1) Process water Pump 2) Mist Eliminator wash. The best of the parameter for auxiliary power consumption quoted by any qualified bidder shall be taken as the base or ceiling value. Adjustment factor for excess power consumption in USD = (GPC-CV) X PL X No's of Working pumps. Exchange rate as applicable on price bid opening date will be considered. GPC- Guaranteed Power Consumption quoted by bidder in KW CV- Ceiling Value for Guaranteed Power Consumption in KW PL- Power Loading per KW shall be US Dollars 1899
8.0	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 USD = (GPC-APC) X P X Total No's of Working pumps for Where • GPC- Guaranteed Power Consumption quoted by bidder in KW • APC- Actual Power Consumption in KW • P- Penalty per KW : 1899 USD/KW

9.0	PACKING AND FORWARDING
1.	Each package or shipping units shall be clearly marked or stenciled on at least two sides as PRE Annexure A BHEL SITE OFFICE BARH-II- 2x660 MW, NATIONAL THERMAL POWER CORPORATION BIHAR,PATNA, INDIA EPC CONTRACTOR: BHARAT HEAVY ELECTRICALS LIMITED, INDIA" In addition, each package or shipping unit shall have the symbol painted in red on at least two sides of the package, covering one fourth of the area of the side.

GENERAL SPECIFICATION FOR WATER PUMPS OF NTPC PROJECT

CONFIDENTIAL

CUSTOMER	: NTPC
APPLICATION	: FLUE GAS DESULPHURIZATION SYSTEM



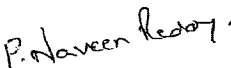
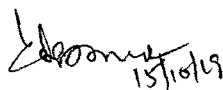
**Flue Gas Desulphurization
Air Quality Control Systems
Bharat Heavy Electrical Limited
Ranipet – 632 406.**



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TECHNICAL SPECIFICATION FOR WATER PUMPS

Department	Prepared	Checked	Approved
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Revision – 00 Dated 15/10/2019		COMMENTS : ----	

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1.0 PROJECT INFORMATION:

As per Annexure A , Clause 1.0

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.

3.0 WATER ANALYSIS:

As per Annexure A , Clause 3.0

4.0 INTENT OF SPECIFICATION

This specification covers the minimum requirements for the complete design, material, manufacturing, shop inspection, testing at the manufacturer's works, supervision of erection & performance testing at bidder's works of water pumps along with accessories which is furnished in the Flue Gas Desulphurization system. The following points may be noted.

- a. Each unit is envisaged with one FGD system. The details for the pumps is envisaged in the Annexure A.
- b. Bidder shall assume full unit responsibility for the entire equipment assembly and make all possible efforts to comply strictly with the requirements of this specification and other specifications/attachments to inquiry/order.
- c. In case, deviations are considered essential by the Bidder (after exhausting all possible efforts), the same shall be separately listed in the Bidder's proposal under separate section, titled as "List of Deviations/Exceptions to the Enquiry Document (Annexure-IV)".
- d. Any deviation, not listed under the above section, even if reflected in any other portion of the proposal, shall not be considered applicable.
- e. No deviation or exception shall be permitted without the written approval of the purchaser.
- f. Compliance to this specification shall not relieve the Bidder of the responsibility of furnishing equipment and accessories/auxiliaries of proper design, materials and workmanship to meet the specified start up and operating conditions.
- g. In case, the Bidder considers requirement of additional instrumentation, controls, safety devices and any other accessories/auxiliaries essential for safe and satisfactory operation of the equipment, the same shall be recommended along with reasons in a separate section and include the same in scope of supply.
- h. All accessories, items of work, though not indicated but required to make the system complete for its safe, efficient, reliable and trouble free operation and maintenance shall also be in supplier's scope unless specifically excluded.



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5.1 Scope of Supply & Services

1. All the pumps shall be supplied along with individual drive motor (IE3), Base Plate along with required isolations, Coupling, Foundation Bolt and valves, Expansion Bellows(Neoprene) at inlet & outlet & other accessories as required.
2. Bidder's Service Engineer shall visit the site for supervision of Erection and commissioning of the pumps.
3. Supervision of Erection and Commissioning of the all pumps at project site
4. First Fill of Consumables, Oil & Lubricants shall be supplied.

5.2 Annexure II: Data Sheet to be filled by vendor: (to be filled by bidder for each pump)

Sl. No		Description	Value		
TECHNICAL DETAILS					
1	Make				
2	Model				
3	Application				
4	Design Flow at Rated Speed (m3/hr)				
5	Minimum & Maximum Continuous Flow (m3/hr)				
6	Total Discharge Head @ design flow MWC				
7	Shut off Head @ MWC				
8	NPSH required (minimum) @ MWC				
9	Hydraulic test pr.@ Kg/Sq. Cm				
10	Pump efficiency -				
10.1	At design point %				
10.2	At maximum flow %				
11	Pump shaft power reqd. at design point @ KW				
12	Maximum shaft power required @ KW				
13	Selected motor @ KW				
14	Rated speed & critical speed @ rpm				
15	GD2 of the pump @ kgm2				
16	Operating flow range from design point % : + -				



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17	Noise level at duty range dBA at 1.0 m distance			
18	Vibration level -			
18.1	Displacement microns			
18.2	Velocity (Peak) mm/sec			
19	Balancing quality as per ISO 1940 std.			
20	Rotation of shaft viewing from drive end			
21	Tolerance on head and efficiency at rated speed and flow.			
CONSTRUCTIONAL DETAILS				
1.0	Suction / Discharge nozzle			
1.1	Size mm			
1.2	Rating psi			
1.3	Flange drilling standard			
1.4	Nozzle Orientation looking from DE			
2.0	Material of construction / make			
2.1	Pump casing			
2.2	Impeller			
2.3	Shaft			
2.4	Shaft sleeve			
2.5	Wear rings			
2.6	Diffuser			
2.7	Mechanical seal			
2.8	Bearing housing			
2.9	Fasteners			
2.10	Others if any			
3.0	No. of stage			
3.1	Impeller type			
3.2	Impeller diameter Trimmed / Untrimmed			
4.0	Bearings			
4.1	Type			
4.2	Make			
4.3	Lubrication Oil - Specification			
4.4	Lub. Oil Quantity / pump Litre			



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5.0	Mechanical seal			
5.1	Type			
5.2	Make			
5.3	Model			
5.4	Drawing No			
6.0	Performance curve references No.			
7.0	Foundation Draws No.			
7.1	Pump Dimension L x W x H in mm			
7.2	Pump Weight in Kg			

COUPLING

1.0	Type			
2.0	Make , Model No			
3.0	Coupling guard Material			
4.0	Dimension detail with BOM enclosed			
5.0	Weight in Kg			

BASE FRAME AND ACCESSORIES

1.0	Material			
2.0	Dimension detail in mm			
3.0	Weight kg :			

GENERAL

1.0	Shipping package dim. in mm			
2.0	Total assembly weight in Kg			
3.0	Total shipment weight in Kg			

6.0	TECHNICAL REQUIREMENTS
	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.
1.	The design of the shaft shall ensure that the operating speed is at least 20% above the critical speed of the shaft.
2.	The pump shall be provided with seals of proven type and shall be designed for minimization of seal water consumption. The shaft shall be supported on heavy duty ball/roller bearings.
3.	All pumps shall be designed to withstand a test pressure of 1.5 times the maximum possible pump shut off pressure under maximum suction pressure conditions
4.	The Pump flow/head characteristics shall be such that within the operation range the head will continuously increase with decreasing flow, maximum head (shut off head) being at least 10% higher than the duty point head.



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5.	All pumps shall be fitted with suction and discharge pressure gauges											
6.	Each pump will have a coupling of adequate size, designed for full load and capable of supporting start –Up an overload moment.											
7.	The Antifriction bearing of the pumps shall be designed for minimum useful life (L-10) of 25,000 hours of continuous operation (Under the design condition). The thrust bearing will have dimensions for a minimum of 175 % of the required load.											
8.	Pump induced vibration due to flow pulsations shall be avoided through suitable design.											
9.	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).											
10.	Pumps shall run smoothly without undue noise and vibration. Peak to peak vibration limits shall be restricted to the following values during operation: <table><tr><td>Speed</td><td>Antifriction Bearing</td><td>Sleeve Bearing</td></tr><tr><td>1500 rpm and below</td><td>75.0 micron</td><td>75.0 micron</td></tr><tr><td>3000 rpm</td><td>50.0 micron</td><td>65.0 micron</td></tr></table>			Speed	Antifriction Bearing	Sleeve Bearing	1500 rpm and below	75.0 micron	75.0 micron	3000 rpm	50.0 micron	65.0 micron
Speed	Antifriction Bearing	Sleeve Bearing										
1500 rpm and below	75.0 micron	75.0 micron										
3000 rpm	50.0 micron	65.0 micron										
11.	The pumps shall be capable of starting with discharge valve fully open and close condition. Motors shall be selected to suit to the above requirements. Minimum motor margin (as per table below) shall be provided above maximum load demand of the pump in the entire operating range to take care of the system frequency variation and no case less than the maximum power requirement at any condition of the entire characteristic curve of the pump. Continuous Motor rating shall be at 50 deg.C ambient. Motor margin shall be as below <table><tr><td>Pump rated BKW</td><td>Motor rating</td></tr><tr><td><22 kW</td><td>125% of pump rated BKW</td></tr><tr><td>22 kW – 55 kW</td><td>115% of pump rated BKW</td></tr><tr><td>>55 kW</td><td>110% of pump rated BKW</td></tr></table>			Pump rated BKW	Motor rating	<22 kW	125% of pump rated BKW	22 kW – 55 kW	115% of pump rated BKW	>55 kW	110% of pump rated BKW	
Pump rated BKW	Motor rating											
<22 kW	125% of pump rated BKW											
22 kW – 55 kW	115% of pump rated BKW											
>55 kW	110% of pump rated BKW											
12.	Make of the Bearings : SKF/FAG only.											
6.1	CONSTRUCTIONAL FEATURES											
	General:											
	The pumps shall be complete with drive motors, baseplate and other accessories. The constructional features of the pump shall be as follows: a). Pump casing may be axially or radially split. The casing shall be of robust construction. Casing drain and vent connections shall be provided. b). Impeller shall be made in one piece and securely keyed to the shaft. Locking device shall be											



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provided to prevent its loosening during all conditions of operation.

c). Wearing rings shall be of renewable type. Opposed wearing surface shall be of hardened material and shall have a hardness difference of at least 50 BHN.

d). Replaceable shaft sleeves shall be provided to protect the shaft where it passes through bearings and stuffing boxes. The end of the shaft sleeve assembly shall extend through the packing gland. Shaft sleeve shall be securely locked or keyed to the shaft to prevent loosening or rotation. Shaft and shaft sleeves shall be machined and assembled for concentric rotation.

e). The design of the shaft shall take into consideration the critical speed, which shall be at least 20% away from operating speed.

f). Pump bearings shall be of antifriction type. Bearings shall be readily accessible without disturbing the alignment of pump.

g). Packed stuffing boxes shall be of sufficient length to prevent leakage along the shaft and shall be complete with all packing and lantern rings required.

h). Pumps shall be furnished complete with an approved type of flexible - coupling.

i). Couplings guards made of expanded metal and bolted to the base plate shall be furnished.

j). The common base plate for pumps and motor shall be in one piece and shall be made of fabricated steel.

k). Pump speed shall be less than 1500 rpm for pumps of capacity more than 10 m³/hr.

l). The Pump shall be capable of developing the required total head at rated capacity for continuous operation. Also the pumps shall be capable of being operated to give satisfactory performance at any point on the HQ characteristics curve. The operating range of the pump shall be 20% to 120% of the duty point unless otherwise mentioned elsewhere. The maximum efficiency of pump shall preferably be within $\pm 10\%$ of the rated design flow as indicated in data sheets.

m). 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.

The power, head and flow characteristics of each pump shall be suitable for parallel operation. The Power characteristics of the pumps shall be of non-overloading type. All rotating parts of the pumps shall be statically and dynamically balanced.

The motor shall be rated for continuous operation and confirm to companion electrical specification. However, motor rating shall not be less than the max. power demand throughout the entire range of operation of pump. Design duty point of pump shall match with the average value of maximum and minimum flow rates of the pump in the stable operation zone.

A) Casing, Gland & Stuffing Box

- a. The material of the Casing, Gland & Stuffing Box shall be of **2.5 Ni Cast iron to IS 210 Grade FG or equivalent.**
- b. The casing and flanges shall be designed to withstand the maximum shut-off pressure developed by the pump at the pumping temperature.



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c.	Pressure casing shall be designed with a corrosion allowance to meet the requirement "Technical requirements" and taking into account the "Operating Parameters".
d.	Connection for suction and discharge pressure gauge shall be provided as standard feature.
e.	Lifting provision of pump should be provided.
B)	IMPELLER & Wearing Rings (As applicable)
a.	The Impeller & wearing Rings (as applicable) material shall be of <u>Stainless Steel 316</u> grade.
b.	Miller number for the material should be justified for that pumping medium as per ASTM G75-95 as well as the corrosion effect of pumping medium.
c.	Impeller as rotating assembly along with all elements should be dynamically balanced according to ISO 1940
d.	Impeller tip speed shall be within vendor's experience. And Impeller shall have air bleed holes to eliminate any air accumulation around the shaft seal
e.	Maximum size impellers for the pump body shall not be quoted for. By installation of a new impeller, a head increase of 5% minimum shall be possible.
C)	SHAFT AND SHAFT SLEEVES
a.	All Shafts & Shaft Sleeves shall be of SS 410 grade. All Pump shafts shall be of ample size to transmit the maximum possible output from the prime mover.
b.	The pump shaft and coupling are to be so dimensioned that the maximum permissible torque of the shaft is higher than the maximum transmissible torque of the coupling.
c.	Pumps shall operate smoothly throughout the speed range up to their operating speeds. The first coupled critical speed must be at least 20% higher than the maximum operating speed. The determination of the shaft diameter and the distance between two consecutive bearings must include a sufficiently large safety margin to satisfy this condition.
d.	Shafts shall be conservatively designed to transmit maximum power required and to assure rigidity. Shafts shall be machined and ground to close tolerances and shall be tapered to permit easy removal of the seals and bearings.
D)	BASE PLATE
a.	A common base plate shall be provided for pump assembly & Motor and the same shall be rigidly constructed, adequately braced and provided with finish pads for mounting pump.
b.	Suitable holes shall be provided for grouting and these shall be so located that the base plate can be grouted in place without disturbing the pump and motor.



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c.	Common base plate for Pump and Motor shall be in the scope of the bidder.
d.	Base plate must be stress-relieved for any residual welding stress and certificate to that effect is to be submitted as per inspection requirement.
E)	BEARINGS
a.	The bearings may be ball, roller or sleeve bearing. If sleeve bearings are used these shall be machined for close running fit. The bearings shall be designed to take the necessary radial load as well as the net axial thrust.
F)	ACCESSORIES:
1.	Expansion Joints:
i.	Expansion Joints with limiting bolt & nuts shall be provided at suction and discharge of each pump
2.	Pump shall be provided with accessories such as Coupling guard, drain plugs, Vent Valves etc
3.	FASTENERS
l	All fasteners to be SS316 only.

6.1 POWER SUPPLY

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



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above mentioned power supply condition.

6.2	PACKING AND FORWARDING
1.	Proper packing to be ensured. Indigenous Supply: Pump & sub system assembly shall be wrapped in polythene bags & packed in a strong rigid wooden crate. Rain water should not enter into the pump internals during storage in the outer yard of power plant. <u>Imported Supply:</u> All imported supply should be packed as per Sea worthy packing standards Annexure - VI. All imported items should have Sea worthy packing. Liberal packing materials and struts shall be provided to arrest rolling and to protect from transit damages.
2.	Equipment and process materials shall be packed and semi-knocked down, to the extent possible, to facilitate handling and storage and to protect bearings and other machine surfaces from oxidation. Each container, box, crate or bundle shall be reinforced with steel strapping in such a manner that breaking of one strap will not cause complete failure of packaging. The packing shall be of best standard to withstand rough handling and to provide suitable protection from tropical weather while in transit and while awaiting erection at the site.
3.	Equipment and materials in wooden cases or crates shall be properly cushioned to withstand the abuse of handling, transportation and storage. Packing shall include preservatives suitable to tropical conditions. All machine surfaces and bearings shall be coated with oxidation preventive compounds. All parts subject to damage when in contact with water shall be coated with suitable grease and wrapped in heavy asphalt or tar impregnated paper.
4.	Crates and packing material used for shipping will become the property of owner.(NTPC)
5.	Packing (tare) shall be part of the equipment cost and shall not be subject to return. The packing should ensure integrity and cohesiveness of each delivery batch of equipment during transportation. In case of equipment assemblies and unit's delivery in the packing of glass, plastics or paper the specification of packing with the material and weight characteristics are to be indicated.
6.	Each package should have the following inscriptions and signs stenciled with an indelible ink legibly and clearly: - Destination - Package Number - Gross and Net Weight - Dimensions - Lifting places



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	f. Handling marks and the following delivery marking
7.	Each part of the equipment which is to be shipped as a separate piece or smaller parts packed within the same case shall be legibly marked to show the unit of which it is part, and match marked to show its relative position in the unit, to facilitate assembly in the field. Unit marks and match marks shall be made with steel stamps and with paint.
8.	Each case shall contain a packing list showing the detailed contents of the package. When any technical documents are supplied together with the shipment of materials no single package shall contain more than one set of such documents. Shipping papers shall clearly indicate in which packages the technical documents are contained.
9.	The case number shall be written in the form of a fraction, the numerator of which is the serial number of the case and the denominator the total number of case in which a complete unit of equipment is packed.
10.	Wherever necessary besides usual inscriptions the cases shall bear special indication such as "Top", "Do not turn over", "Care" , "Keep Dry" etc. as well as indication of the center of gravity (with red vertical lines) and places for attaching slings (with chain marks)
11.	Marking for Safe handling: To ensure safe handling, packing case shall be marked to show the following: a. Upright position b. Sling position and center of Gravity position c. Storage category d. Fragile components (to be marked properly with a clear warning for safe handling)
12.	Each crate or package is to contain a packing list in a waterproof envelope. All items are to be clearly marked for easy identification against the packing List. All cases, packages etc. are to be clearly marked on the outside to indicate the total weight where the weight is bearing and the correct position of the slings are to bear an identification mark relating them to the appropriate shipping documents. All stencil marks on the outside of cases are either to be made in waterproof material or protected by shellac or varnish to prevent obliteration in transit.
13.	The packing slip shall contain the following information: - Customer name, Name of the equipment, Purchase Order number with Date, Address of the delivery site, Name and Address of the Sender, Serial Number of pump & accessories, BHEL item Code, Gross Weight and Net weight of Supplied items.
14.	Prior to transport from manufacturer's work to destination, components of the unit shall be completely cleaned to remove any foreign particles. Flange faces and other machined surfaces shall be protected by an easily removable rust preventive coating followed by suitable wrapping.
6.3	Motor



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6.3.1 General

This specification generally covers the requirement for motors involved in Slurry Pumps system package. Technical Specification TECI:LT MOTOR:REV 02 Dated: 30.01.2017 to be also gone through.

6.3.2 Voltage level:

The voltage level for motors shall be as follows:

S.No	Rating	Voltage	Freq and voltage variation
1	Upto 0.2 kw	Single phase 240V AC / Three phase 415V AC	1. 50 Hz- +3% & -5 % 2. 10% combined variation of voltage & frequency.
2	Above 0.2 and up to 200 kw	Three phase 415V AC	

6.3.3 Starting voltage requirement

Up to 85% of rated voltage for ratings below 110 KW

Up to 80% of rated voltage for ratings from 110 KW to 200 KW

- Voltage rating for special purpose motors viz, VFD shall be as per manufacturer's standard.

6.3.4 Degree of protection:

S.NO	Item	Indoor	Outdoor
1	Motors	IP 54	IP 55
2	Cable box	IP 54	IP 55

6.3.5 Efficiency class:

Premium efficiency IE3 (For Continuous duty motors up to 200 kw) as per IS 12615, IEC:60034-30

6.3.6 General requirements:

S.No	Parameters	To be confirmed by vendor	Vendors confirmation
1	Direction of rotation	Suitable for both directions	



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2	Class of Insulation	Thermal class 155 (F) insulation		
3	Winding Insulation	The winding insulation process shall be Global Vacuum Pressure Impregnated i.e. resin poor method		
4	Starting Current	1. Less than or equal to 600 % full load current subject to tolerance as per IS (Normal motor) 2. Less than or equal to 700 % full load current subject to tolerance as per IS (Normal motor)		
5	Starting Voltage	1. Up to 85% of rated voltage for ratings below 110 KW 2. Up to 80% of rated voltage for ratings from 110 KW to 200 KW		
6	Torque requirement	1. Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque. 2. Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.		
7	Type of enclosure	1. Motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. 2. VFD driven motors to be offered with forced cooling type with machine mounted fan or pump driven by separate electric motor.		
8	Dimensions of Terminal box for LV motors	Motor MCR	Distance between center of stud & gland plate (in mm)	
		a. Upto 3 Kw b. Above 3 kw to 7 kw c. Above 7 kw to 13 kw d. Above 13 kw to 24kw e. Above 24 kw to 37kw f. Above 37 kw to 55kw g. Above 55 kw to 90kw	As per manufacturer's practice 85 115 167 196 249 277	
9	Cable glands & Lugs	Double compression type Nickel plated brass cable gland & insulated tinned copper crimping lugs to suit the cable sizes		



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10	Paint shade	RAL 5012 (Blue)	
11	Space heaters	Suitable single phase space heaters shall be provided on motors rated 30KW and above. Separate terminal box for space heaters shall be provided	

6.3.7 Locked rotor withstand time

S.No	Starting time at min permissible voltage	Locked rotor withstand time
1	Upto 20 secs	Under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time
2	More than 20 sec & less than 45 sec	Under hot condition at highest voltage limit shall be at least 5 secs. more than starting time
3	More than 45 sec's	under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time

6.3.8 Special Requirement:

Motor operating through variable frequency drives shall be suitable for inverter duty. Also these motors shall comply the requirements stipulated in IEC: 60034-18-41 and IEC: 60034-18-42 as applicable.

6.3.9 Torque Requirements

- Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.
- Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.

7.0	SUPERVISION OF ERECTION, TESTING AND COMMISSIONING
1.	Erection of Water Pumps will be done by owner as per Erection Manual and check List. Supervision of Erection and Commissioning of the all pumps at project site is in bidder's scope. Bidder shall include 5 working days per visit in the offer with minimum three visit for the supervision of erection, pre-commissioning & post-commissioning check-up, start up, testing and trial runs of all the items covered under the scope of supply.



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2.	TA/DA, boarding and lodging shall be borne by the bidder and shall be inclusive in supply portion.
8.0	EXCLUSION
	The following work associated with the water pumps will be by others: a. Civil foundations b. Walkways, platforms and ladders c. Element handling hoists
9.0	INSPECTION AND TESTING
A)	Minimum Testing requirements to be considered are as below:
1.	Hydrostatic test is to be conducted at 150 % of design pressure for duration of 30 minutes, taking into consideration of the fact that actual operating temperature is in the range of 35-45 deg Celsius.
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.	Test certificates shall be issued for each lot of raw material used in the coating, corresponding to specific weight and traction resistance.
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.	Pumps shall be inspected at the Bidder's works before dispatch or where the test facilities are available.
4.	The Bidder shall conduct performance test for the all the 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.



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6.	Acceptance tolerance of actual versus guaranteed performance for capacity, head, efficiency and power absorbed shall be as per applicable standard.
7.	Vibration levels shall be measured during shop running/performance tests.
8.	Mechanical running and the performance test shall be carried out. Bidder to arrange Motor of same / higher rating for the shop test and inspection.

10.0	Other Salient Points
1.	Base plate, Foundation Bolts, Pressure Gauges, Companion Flanges, Coupling, Coupling Guards shall be in scope of bidder's supply
2.	The design of shaft shall ensure that the operating speed is at least 20% above the critical speed of the shaft.
3.	Recommended motor power consumption to be provided by bidder.
4.	The pump shall be provided with seals of proven type and shall be designed for minimization of seal water consumption.
5.	Make of Mechanical Seals: Eagle Burgmann/ Flowserve/ John crane only. No other make is acceptable

11.0	SPARES, TOOLS & TACKLES
11.1	START UP & COMMISSIONING SPARES
	Start-up & Commissioning Spares shall be part of the main supply of the Water pumps. Start-up & commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. All spares required for successful operation till commissioning of pump shall come under this category. Bidder shall provide an adequate stock of such start up and commissioning spares to be brought by him to the site for the equipment erection and commissioning. The spares must be available at site before the equipments are energized. The List of such spares to be provided by bidders with their offer.
12.0	MANDATORY SPARES
	Bidder to quote for below mentioned mandatory spares with break up price as per Annexure A (Clause 6.0): Note : 1. Unless stated otherwise a 'set' means items or sub-items required for each type/size range of the assembly/ sub-assembly, required for replacement in one main equipment. It is further



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intended that the assembly/ sub-assembly which have different orientation (like left hand or right hand, top or bottom), different direction of rotation or mirror image positioning or any other reasons which result in maintaining two different sets of the spares to be used for the subject assembly/ sub-assembly, these shall be considered as different types of assembly/ sub-assembly.

2. Wherever quantity has been specified as percentage (%), the quantity of mandatory spares to be provided by contractor shall be the specified percentage (%) of the total population of the plant. In case the quantity so calculated happens to be a fraction, the same shall be rounded off to next higher whole number.

3. Whenever the quantities have been indicated for each type, size, thickness, material, radius, range etc., these shall cover all the items supplied and installed and the breakup for these shall be furnished in the bid.

4. In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed in the above list. 5. Price of each and every item is to be given separately.

Any change in size, material, design etc, which obviates one to one replacement of the part shall be considered a different type. Unless otherwise stated, a set shall mean complete replacement for one equipment.

Bidder shall quote for the "Initial Spares Part List", and it will be considered for L1 evaluation. Initial spare parts items shall be handed over separately and shall not be mixed with the supply of the main equipment parts. Spares shall be sent in pre-decided lots in containers/secure boxes. All boxes/containers are to be distinctly marked in red color with boldly written "S" mark on each face of the containers. Spares shall not be dispatched before dispatch of corresponding main equipment's. Each item shall be labelled in English and be packed against damage and sealed to prevent deterioration from corrosion. The protection shall be sufficient for a minimum of 10 years' storage in a dry weatherproof building.

All spares supplied under this contract shall be strictly inter-changeable with the parts for which they are intended for replacements. All the Initial spares shall be manufactures along with the main equipment components as a continuous operation as per same specification and quality plan.

Any special tools & tackles required for the entire equipment to disassemble, assemble or maintain the units, they shall be included in the quotation and furnished as part of the initial supply of the machine.

13.0 DEFECT LIABILITY & WARRANTY

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 Twenty four (24) months from the date of delivery or eighteen (18) months from the date of commissioning, whichever first occurs. If during the Defect Liability Period any defect should be found in the design, engineering, materials and workmanship of the Plant and Equipment supplied or of the work executed by the Bidder, the Bidder shall promptly, in consultation and agreement with BHEL regarding appropriate remedying of the defects, and at its cost, repair, replace or otherwise make good (as



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	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 .
14.0	FIRST FILL OF CONSUMABLES:
1.	Bidder's scope shall also include supply and filling of all , lubricants, grease items for operation up to commissioning including top up requirements. All lubricants proposed for the plant operation shall be suitable for all operating and environmental conditions that will be met on site consistent with good maintenance procedures as instructed in the maintenance manuals.

15.0	PERFORMANCE GUARANTEE
	All performance tests for Water pumps shall be carried out in accordance with any latest international codes/standards. 1) Bidder shall furnish Performance guarantee for the design, manufacture, material, safe and trouble-free operation of the water pumps and its accessories 2) Bidder shall guarantee and demonstrate the rated capacity of the pump at the rated head. 3) The Bidder shall ensure a design of the equipment to achieve an average target availability of 98% of pump for a continuous period of 120 days. 4) All the wear parts of the pump shall be guaranteed for a minimum wear life of not less than 20000 hrs. 5) Noise level-≤ 85 dB (A) at 1m horizontal distance from equipment/enclosures and 1.5m above operating floor is to be guaranteed. 6) Vibration levels measured on the non-rotating parts shall not exceed the zone limit "B" as defined in ISO 10816 at steady conditions and shall not exceed the zone limit "C" as defined in ISO 10816 at transient conditions. 7) Acceptance tests to be carried out as per the procedure defined by the bidder which shall be submitted for customer approval. 8) In the event that the performance test is unsuccessful, bidder shall take necessary remedial action at his cost and the performance test shall be repeated.
16.0	BID EVALUATION CRITERIA FOR POWER CONSUMPTION:



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	As per Annexure A Clause 7.0
17.0	LIQUIDATED DAMAGES FOR POWER CONSUMPTION
	As per Annexure A Clause 8.0
18.0	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 per Annexure V. Annexure V 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 as specified under Annexure V. All necessary GA drawings, sections, sub-assembly drawings, specifications of main and sub components and necessary set of operation & maintenance manual as asked by NTPC must be furnished by bidder in soft and hard copy forms. Unless agreed otherwise, Ten (10) hard copies and five (05) sets of electronic copies of all documents are to be submitted in the English language. Electronic Copies shall be submitted in primary original data format (e.g. DOC, XLS, DWG) as well as in a printable non-proprietary document format (e.g. PDF). However all the engineering related information shall be furnished in soft form to BHEL.



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19.1 ANNEXURE III- SCHEDULE OF GUARANTEES

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

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----



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19.2

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

Sl No	Clause No	Page No	Description of Deviation

Note: Enlarge the table to incorporate items

SIGNATURE OF BIDDER _____

NAME _____

DESIGNATION _____



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19.3

ANNEXURE –V

A) DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER:

Sl. No.	Description	No of copies With proposal
1.	Specification duly signed and seal on each page	1
2.	Anchor Plan & Civil foundation Loading details	1
3.	GA drawings of pump assembly	1
4.	Data Sheet	1
5.	Performance curve	1
6.	Test Arrangement & Test procedure	1
7.	Proforma Packing List	1
8.	Shortest Manufacturing Time	1
9.	Approximate weight of each skid	1
10.	Reference plant details	1
11.	Required Electric power & other Utility List	1
12.	Deviation List	1
13.	Scope of Supply	1
14.	Start-up & Commissioning Spares	1
15.	List of Special Tools	1
16.	Delivery Schedule	1
17.	T-S curve	1
18.	Catalogue	1



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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.	Foundation Data including Anchor plan	1	2 weeks after contract
3.	Performance curve	2	2 weeks after contract
4.	Assembly drawings of each equipment	1	1 month after contract
5.	Cross section detail drawing	1	1 month after contract
6.	Data Sheet	1	2 weeks after contract
7.	Lubricating oil list	1	2 months after contract
8.	Special tools list	1	2 months after contract
9.	Installation and assembly procedure	1	4 months after contract
10.	Inspection and Test Procedure	1	1 month after contract
11.	Inspection & Test record	1	In 2 weeks after test
12.	Inspection Certificate	1	In 2 weeks after test
13.	Sub vendors List	1	2 weeks after contract
14.	Manufacturing Schedule	1	2 weeks after contract
15.	Progress report	1	Every month
16.	Proforma Packing List	1	2 months prior to shipping
17.	Approximate weight of each skid	1	2 months after contract
18.	Required Electric power	2	2 weeks after contract
19.	Pump and Motor Sizing Calculation	1	2 weeks after contract
20.	Material Test Certificates	2	In 2 weeks after test
21.	Pre Commissioning Check List	2	4 months after contract
22.	Scope of Supply	2	2 weeks after contract
23.	Quality Plan	4	1 month after contract
24.	Operation and Maintenance Manual	• 10 hardcopies and 5 electronic copies in English	4 months after contract
25.	Start-up & Commissioning Spares	2	1 month after contract



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Sl. No.	Description	No of copies After award of contract	Delivery Time
26.	List of Special Tools	1	1 month after contract
27.	Delivery Schedule	1	2 weeks after contract
28.	Test Arrangement & Test procedure	2	1 month after contract
29.	T-S curve	2	2 weeks after contract
30.	P & I Diagram	2	2 weeks after contract
31.	Catalogue	2	2 weeks after contract

SIGNATURE OF BIDDER

NAME

DESIGNATION



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19.4

ANNEXURE-VI : TECHNICAL SPECIFICATION FOR SEAWORTHY PACKING

Applicable for Import Supply

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

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----



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19.5 ANNEXURE-VII: INSPECTION & TESTING

Vendor to confirm acceptance to all clauses for Inspection & testing requirements as per spec.

SIGNATURE OF BIDDER _____

NAME _____

DESIGNATION _____



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19.6 ANNEXURE-VIII:

REFER TO MOTOR SPECIFICATION. DATASHEET HAS TO BE SUBMITTED IN THE FORMAT BELOW. LT MOTOR SHALL BE FROM VENDORS APPROVED BY NTPC

DE-1	LT MOTORS	
A.	GENERAL	
1.	Manufacturer & Country of origin.	
2.	Equipment driven by motor	
3.	Motor type	
4.	Quantity	
B.	DESIGN AND PERFORMANCE DATA	
1.	Frame size	
2.	Type of duty	
3.	Type of enclosure /Method of cooling/ Degree of protection	
4.	Applicable standard to which motor generally conforms	
5.	Efficiency class as per IS 12615(IE3)	
6.	(a)Whether motor is flame proof	
	(b)If yes, the gas group to which it conforms as per IS:2148	
7.	Type of mounting	
8.	Direction of rotation as viewed from DE END	
9.	Standard continuous rating at 40 deg.C. Ambient temp. as per Indian Standard (KW)	
10.	Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)	
11.	Maximum continuous load demand of driven equipment in KW	
12.	Rated Voltage (volts)	
13.	Permissible variation of :	
	a. Voltage (Volts)	
	b. Frequency (Hz)	
	c. Combined voltage and frequency	
14.	Rated speed at rated voltage and frequency(RPM)	
15.	At rated Voltage and frequency:	
	a. Full load current	
	b. No load current	
16.	Power Factor at	



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	a. 100%/75%/50% load	
	b. NO load	
	c. Starting.	
17.	Efficiency at rated voltage and frequency,	
	a.100% load	
	b. 75% load	
	c. 50% load	
18.	Starting current (amps) at	
	a. 100 % voltage	
	b. 85% voltage	
	c. 80% voltage	
19.	Minimum permissible starting Voltage (Volts)	
20.	Starting time with minimum permissible voltage/80%/ 100%/ 110%	
	a. Without driven equipment coupled	
	b. With driven equipment coupled	
21.	Safe stall time with 100% ,110% & 80% of rated voltage	
	a. From hot condition	
	b. From cold condition	
22.	Torques :	
	a. Starting torque at min. permissible voltage(kg-mtr.)/ rated voltage	
	b. Pull up torque at rated voltage.	
	c. Pull out torque	
	d. Min accelerating torque (kg.m) available at lowest permissible starting voltage	
	e.Rated torque (kg.m)	
23.	Stator winding resistance per phase (ohms at 20 Deg.C.)	
24.	GD ² value of motors	
25.	No of permissible successive starts when motor is in hot condition	
26.	Locked Rotor KVA Input	
27.	Locked Rotor KVA/KW	
28.	Vibration limit :Velocity (mm/s)	
29.	Noise level limit (dBA)	
C.	CONSTRUCTIONAL FEATURES	



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1.	Stator winding insulation	
	a. Class & Type	
	b. Winding Insulation Process	
	c. Tropicalised (Yes/No)	
	d. Temperature rise over specified maximum ambient temperature of 50 deg C	
	e. Method of temperature measurement	
	f. Stator winding connection	
2.	Main Terminal Box	
	a. Type	
	b. Location(viewed from NDE side)	
	c. Entry of cables(bottom/side)	
	d. Recommended cable size(To be matched with cable size envisaged by owner)	
	e. Fault level (MVA),Fault level duration(sec)	
	f. Cable glands & lugs details (shall be suitable for power cable)	
3.	Type of DE/NDE Bearing	
4.	Motor Paint shade	
5.	Weight of	
	a. Motor stator (KG)	
	b. Motor Rotor (KG)	
	c. Total weight (KG)	
D.	List of accessories.	
1.	Space Heaters (Nos./Power in watts/supply voltage)	
2.	Terminal Box for Space Heater (Yes/No)	
3.	Speed switch (Yes/No) No of contacts and contact ratings of speed switch	
4.	Insulation of bearing (Yes/No)	
5.	Noise reducer(Yes/No)	
6.	Grounding pads	
	i) No and size on motor body	
	ii) Nos on terminal Box	
7.	Any other fitments	
E	List of curves.	
1.	Torque speed characteristic of the motor	
2.	Thermal withstand characteristic	



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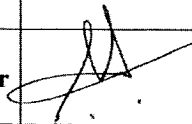
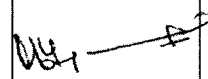
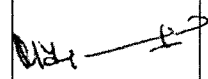
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3.	Starting. current Vs. Time	
4.	Starting. current Vs speed	
5.	P.F. and Effi. Vs Load	

SIGNATURE OF BIDDER _____

NAME _____

DESIGNATION _____

TITLE : TECHNICAL SPECIFICATION FOR BOUGHT OUT ITEMS ITEM : LT MOTOR Project : BHEL standard				
		DESIGNATION	SIGNATURE	DATE
NAME				
PREPARED	K S S MANIAN	Ex Addl Engr		31.01.17
CHECKED	M JEYAMURUGANAND	S D G M		31.01.17
APPROVED	M JEYAMURUGANAND	S D G M		31.01.17
ISSUED BY EDC ECI Record of revision				
REVISION NO : 02		CI 39.0 PACKING DRAWING INCLUDED		
REVISION NO : 01		CI 2.1 Reviewed & Revised		
REVISION NO : 00		INITIAL RELEASE : 19.3.2013 Based on TDC TCI 140 Rev 08 & TFN LTM rev 05		

CI No.	CHARACTERISTICS	REQUIREMENT	VENDOR COMPLIANCE (Refer Note: 2)
1.0	<u>SITE CONDITIONS</u>		
1.1	Altitude above mean sea level	> 1000 m.	
1.2	Ambient temperature condition	6 to 50°C.	
1.3	Relative humidity	100 %	
1.4	Atmosphere	Tropical ,Dusty, salty, corrosive & highly polluted	
2.0	<u>GENERAL</u>	in a coal based Thermal power plant.	
2.1	Reference standards	IS 325, IS 1231, IS 4722, IS 6362, IS 2253, IS 12065, IS 12075 , IS 4691 & <u>IS 12615- Energy efficient</u>	
2.2	Design ambient	50 Deg C	
2.3	Application/ Type(Normal/ Energy efficient)	As per Enquiry & PO.	
2.4	Duty cycle	Continuous S1	
2.5	Rated voltage, frequency & Phases	415 V AC $\pm 10\%$; 50 Hz $\pm 5\%$;(PI check enquiry for voltage) 10% absolute sum - 3 phase	
2.6	Minimum starting voltage	80% of the rated voltage	
2.7	Minimum voltage under which motor will run satisfactorily Capacity to restart (at voltage specified in point No. 2.4)	75% of the rated voltage for 5 minutes i. TWO successive starts from cold condition ii. Two HOT restarts starts from Hot condition iii. Three equally spread start per hour	
2.8	High speed bus transfer withstand capability	Suitable to withstand 150 % of rated voltage	
2.9	Type of balancing for rotor	Dynamic balancing	
2.10	Direction of rotation	Suitable for both direction	
2.11	Direction of cooling air	Non-drive end to driving end	
2.12	Class of insulation	Class F with temperature rise limited to Class B.	
2.13	Winding treatment	The insulation shall be given tropical and fungicidal treatment for successful operation of the motor in hot , humid & tropical climate.	
2.14	Allowed winding temperature rise at continuous full load	60°C by thermometer method & 70°C by resistance method	

CI No.	CHARACTERISTICS	REQUIREMENT	VENDOR COMPLIANCE (Refer Note: 2)
2.15	Starting current	Less than or equal to 600% full load current subject to tolerance as per IS.(Normal motor) Less than or equal to 700% full load current subject to tolerance as per IS.(Energy efficient)	
2.16	Starting time & locked rotor withstand time	The locked rotor withstand time (LRWT) at 110% rated voltage (RV) under HOT condition shall be at least 3 sec more than the starting time at 80% of rated voltage for motors with acceleration time upto 20 sec at RV and 5 sec where the accelerating time is more than 20 sec at RV.	
2.17	Vibration	The peak amplitude of vibration shall be as per IS 12075	
2.18	Noise level	Within the limits specified by IS 12065. (<80 db at full load condition) @ 1 metre distance.	
2.19	Type of enclosure	TEFC, IP 55 as per IS 4691.	
2.20	Type of mounting	Horizontal foot mounted.	
2.21	Bearings	Ball or roller type / bearings effectively sealed against ingress of dust. The bearing shall be so constructed that the loss of lubricating grease is kept to minimum. Sealed bearings are also acceptable.	
2.22	Lubricant Type	Grease	
2.23	Bearing life	Bearings shall have a minimum life of 40000 Working hours.	
2.24	Shaft extension	Motors shall be provided with key slotted bare shaft extension with key at the driving end.	
2.25	Terminal box Type	Weather proof IP 55 as per IS 4691, Capable of being turned through 360° in steps of 90°.	
2.26	Cable gland and lugs	Double compression type nickel plated brass cable glands and insulated tinned copper crimping lugs to suit the cable size shall be supplied along with the motor. i) Size of power cables will be intimated after PO. ii) For space heater cable glands and lugs suitable for 2CX2.5 to be provided	
2.27	Type of terminals	Stud / screw type with plain washers, spring washers / checknuts & lugs	

CI No.	CHARACTERISTICS	REQUIREMENT	VENDOR COMPLIANCE (Refer Note: 2)
2.28	Fault level	40 KA for 0.25 Sec (Suitable HRC fuse backup will be provided by BHEL in MCC/switchgear)	
2.29	Painting	Epoxy based paint (Colour shade 631/ Shade 632/ Shade 275/ RAL 5012 as per IS:5. This will be confirmed after PO.	
30.0	Space heaters		
30.0.A	Motors above 30 kW	Separate space heater suitable for 240V, 1 Phase, AC, 50 Hz shall be provided	
30.0.B	Motors below 30 kW	Winding shall be suitable for heating continuously at 24 V, Single phase, AC, 50 Hz	
30.0.C	Terminals for space heater	Separately terminated with clear identification in main terminal box.	
31.0	RTD for winding	Two numbers of Thermistors / RTD for each phase as below are to be provided A. Motors above 37 Kw shall have thermistors Or RTD if specifically called for in enquiry. B. Motor rated 160kW and above shall have RTDs	
32.0	Bearing RTD	For motors 132 Kw and above bearing temperature detectors(RTD) shall also be offered.	
33.0	Terminals for RTD/ Thermistor	Thermistors/ RTDs shall be terminated in a auxiliary terminal box. Details shall be furnished in TB diagram.	
34.0	Earthing	Two no of earthing provisions on terminal box and on motor body	
35.0	Name plate	As per IS 325 and Addl data on name plate:: a. Bearing DE/ NDE details. b. Year of manufacture	
36.0	Lifting Device	Eye bolt or lugs to facilitate safe lifting	
37.0	<u>INSPECTION & TESTING</u>	As per applicable quality plan	

CI No.	CHARACTERISTICS	REQUIREMENT	VENDOR COMPLIANCE (Refer Note: 2)
38.0	<u>DOCUMENTS</u> a) Along with offer: b) After placement of Purchase order (within 15 days)	One set of technical data sheet as per the enclosed format and Motor general arrangement drawing giving foundation details, shaft details. Three sets of the following for approval: 1. Technical Data sheet as per the enclosed format of TECI LTMOTOR REV 00- sh 6 to 8 2. Motor general arrangement drawing giving foundation details, shaft details and weight 3. Motor Terminal box arrangement drawing 4. Motor characteristic curves . 5. Steel crate packing drawing. The following shall be submitted 1. Guarantee certificate. 2. O & M manuals. <u>3. Acceleration time and LRWT calculation shall be submitted for review.</u> a) As per Drawing No:- 3-00-114-39893 b) The packing shall meet the Transport, Environment & Storage hazards. c) As per Packing Procedure QA:CI: STD:PR:03 or as per Manufacturer's Standard Practice subject to approval. <u>Vendor shall check the applicable rated voltage in enquiry.</u>	
39.0	<u>PACKING</u>		

NOTE:

1. Refer current valid list for revision status of Quality Plan & Packing Procedure.
2. In 'Vendor compliance' column Vendor to indicate 'YES', 'NO' or 'NOT APPLICABLE'. Clarification , if any, in this column will not be considered.

PO no ::

DATA SHEET - Cust No :: Project ::

CL. NO	CHARACTERISTICS	Vendor data (To be filled by vendor)
1.0	Application	
1.1	Fan / Load Curve referred	
2.0	Manufacturer	
3.0	Type & frame size	Normal / Energy efficient Frame size:
3.1	Degree of Protection	IP55
4.0	Rated output in kW	
4.1	Rated speed	
5.0	Rated voltage , frequency & phases	• 415 V AC $\pm 10\%$; 50 Hz $\pm 5\%$; (Check voltage as per engy), 10% absolute sum - 3 phase
6.0	Full load current	Amps
7.0	Energy efficient	As per IS 12615
8.0	Efficiency & power factor at Full load	Eff— PF—
9.0	Efficiency & power factor at 75 % load	Eff— PF—
10.0	Efficiency & power factor at 50 % load	Eff— PF—
11.0	Duty Cycle	S1 - Continuous
12.0	Rated torque	
13.0	Starting current	600% of full load current
14.0	No load current (with mechanism coupled)	@ RV and Frequency
15.0	Starting torque in % of full load torque	
16.0	Pull up torque in % of full load torque	
17.0	Pull out torque in % of full load torque	
18.0	No load starting time (without mechanism coupled)	
19.0	Locked rotor withstand time at rated voltage	a. Hot b. Cold
20.0	Locked rotor withstand time at minimum starting voltage	a. Hot b. Cold
21.0	Locked rotor withstand time at 110% rated voltage	a. Hot b. Cold
22.0	Starting time at minimum starting voltage with mechanism coupled	
23.0	Starting time at rated voltage with mechanism coupled	
24.0	Maximum permissible starting time	
25.0	Stator thermal time constant	Minutes
26.0	Type & No of terminals brought out	

CI no	CHARACTERISTICS	Vendor Data (To be filled by vendor)
27.0	Stator winding connection	Delta / star
28.0	Class of insulation & temperature rise	Class F; 60°C by thermometer method / 70°C by resistance method.
29.0	Minimum permissible starting voltage	Volts
30.0	Resistance per phase @20 Deg C (Indicative)	Ohms
31.0	No of successive starts in Hot condition	ONE / TWO
32.0	Quantity and power consumption of space heater	Qty== Watts==
33.0	Direction of rotation	Bi-Directional.
34.0	Bearing make & type	Make:: Drive End; Non Drive End;
35.0	Lubricant quantity , grade & recommended interval of lubrication	
36.0	Type of mounting & shaft orientation <u>Terminal Box</u>	Foot mounting; Horizontal.
37.0	Location & angle of rotation	
38.0	Gland size for stator winding	
39.0	Gland size for space heater	Suitable for 2CX2.5 sq.mm(armoured), if applicable.
40.0	Cable entry	
41.0	GD ² of motor (kg-m ²)	
42.0	Total weight of motor (kg).	
43.0	Weight of stator (kg)	
44.0	Weight of rotor (kg)	
45.0	Anticipated bearing life in Hours	
46.0	Method of connection to driven equipment	
	Limiting rotor temperature for determining safe stall time	☐
47.0	RTD for winding/ Bearing	Applicable YES NO
48.0	Grade of balance of motor	
50.0	Standard continuous rating at 40 Deg C ambient.	
51.0	Derated rating of motor at 50 Deg C.	
52.0	a. Locked Rotor KVA b. Ratio of Locked rotor KVA / Rated KW	
53.0	a. Motor Dynamic Load b. Motor Static load	Upward/ Downward— Upward / Downward—
54.0	PAINT SHADE	

Vendor's signature and seal

Rev No ::

Date ::

The following curves are to be enclosed during datasheet approval.

1. GA drawing , Terminal box arrangement
2. Torque Vs Speed with load curve superimposed.
3. Speed Vs Current
4. Time Vs Current
5. Thermal with stand curve
6. Load Vs Efficiency
7. Load Vs Slip
8. Load Vs Power factor
9. Speed Vs Time
10. Load Vs Current.

The following information shall be specifically provided for motors suitable for VFD drive (if called for in egny during datasheet approval in addition to datasheet.

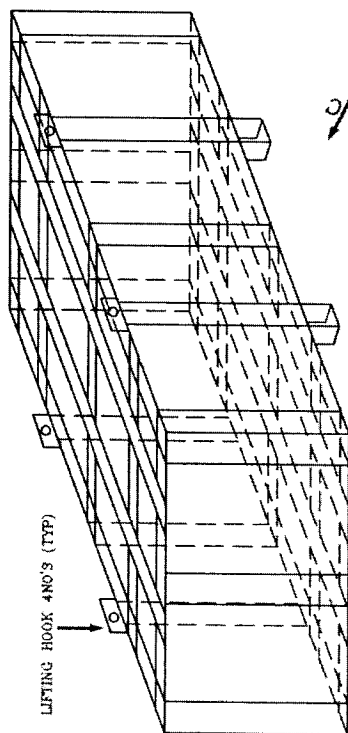
1. Stator RESISTANCE
2. Stator leakage reactance
3. Magnetising reactance
4. Rotor resistance referred to stator
5. Rotor reactance referred to stator

Vendor's signature and seal.

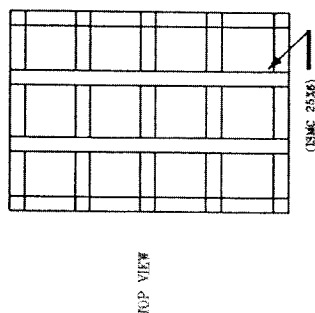
Date ::

NOTES

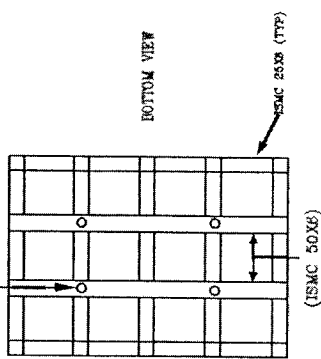
01. LT MOTOR SHALL BE WRAPPED WITH BUBBLED PLASTIC SHEET OVER IRON STEEL CRATE PACKING.
02. STEEL CRATE SIZE : OVERALL SIZE OF MOTOR +200 MM (L, B & H)
03. MATERIAL - STEEL CRATE.
04. LT MOTOR ONE IN EACH CRATE.
05. STEEL CRATE SHALL WITH STAND MECHANICALLY AFTER MULTIPLE LANDING POINTS FOR MOTOR WHEEL STORES LORRY SIDE STORES.
06. MATERIAL CODE PROJECT NAME MOTOR WEIGHT SHALL BE PAINTED BOLDLY ON ANY TWO SIDES OF FRAME FOR IDENTIFICATION.
07. PACKING SLIP INDICATING MOTOR P.O. DETAILS MATERIAL CODE WEIGHT SHALL BE ATTACHED TO MOTOR FRAME FOR IDENTIFICATION.
08. THIS PACKING DRAWING IS TYPICAL AND SHALL SUIT THE MOTOR WEIGHT SUPPLIED.
09. THE PACKING DRAWING INDICATING SIZE AND MATERIAL USED SHALL BE SUBMITTED ALONG WITH DATASHEET FOR BHEL APPROVAL.



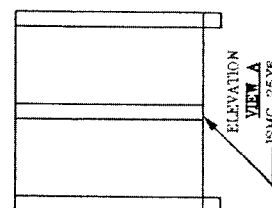
MOTOR SHALL BE FIRMLY BOLTED ON BOTTOM FRAME (TYP).



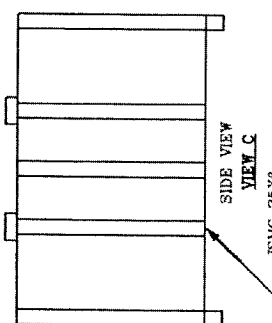
TOP VIEW



BOTTOM VIEW



ELEVATION
VIEW A



SIDE VIEW
VIEW C

PROJECT

CAUTION: THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LIMITED. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.

STANDARD DRAWING

BHARAT HEAVY ELECTRICALS LIMITED.
BOILER AUXILIARIES PLANT.
RAIPUR - 832 406.

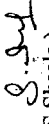
NAME	SIGN	DATE	TITLE
SRIDHAR R	E.S.	30.01.17	PACKING ARRANGEMENT FOR LT-MOTOR (STEEL CRATE)
K.S.S.	A	30.01.17	
M.J.M.			
ALL DIMENSIONS IN MILLIMETER			DRG. No.
FRACTION			3-00-114-39893
SCALE			REV.
NTS			00

Size A2

ANNEXURE B

 Ranipet					DOC. NO: QOR: ELE: G501&G502 REV. NO.: 00 DATE : 17 05 2018 Page 5 of 11		
SL. NO.	ITEM	NTPC APPROVED VENDORS	PLACE	QP CATEGORY	NTPC Type Test Requirements & Quality Plan/Check Lists Requirement		Remarks
04	LT MOTORS	a) KEC	Bangalore/Hubli (Up to 90KW)	Please refer remark column for Categorization	BAP/QOR/ G501 & G502 /LTM:012 Rev NO: 00 dt 17 05 2018	** Acceptance of Motor rating between 30KW to 50 KW is based on NTPC Review of Routine Test Inspection report as per IS 325 Witnessed by BHEL/BHEL AIA ie Main contractor along with COC of the manufacturer and the contractor confirming as follows: "It is hereby confirmed that the above mentioned motor was /motors were manufactured taking care of NTPC specific requirements regarding ambient temperature, voltage and frequency variation, hot starts , pull out torque, starting KVA/KW, temperature rise, distance between centre of stud and gland plate, space heater and in accordance with approved drawing /data sheets" ##Acceptance of Motor less than 30KW is based on COC of the manufacturer and the contractor conforming as follows: "It is here by confirmed that the above mentioned motor/motor was / were manufactured taking care of NTPC specific requirements regarding ambient temperature, voltage and frequency variation, hot starts , pull out torque, starting KVA/KW, temperature rise ,distance between centre of stud and gland plate and tested in accordance with approved drawing /data sheet".	Cat-I <u>Above 50 KW and up to 200KW</u> NTPC inspn as per appd RQP/MQP
		c) CGL	Ahmednagar				Cat-II <u>**From 30KW to 50KW</u> BHEL Inspection
		b) SIEMENS	Mumbai	Please refer remark column for Categorization			# Cat-III <u>Up to 30KW</u>
		c)ABB	Faridabad up to 55KW/ Bangalore above 55KW				
		a) BBL	Mumbai				
		b) NGEF	Hubli (up to 15KW)				
		c) Marathon	Kolkata				
		d) Jyoti	Vadodara				
		e) LHP	Solapur				
		(For other PMD vendors except above NTPC approved vendors, pl refer Sino. 4 under important notes in page no:11)					

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 DGM / QA (Electrics)