

SLP:QR-3K:PNK

Qualification Requirements/Provenness Criteria for Slurry Pump

Project Name :Panki 1X660 MW FGD

Qualification requirement for SLURRY PUMP : The Bidder is required to meet the Provenness criteria and/or qualification requirement for slurry pumps as per criteria stipulated below:

Slurry Pumps for the Wet Limestone based Flue Gas Desulphurization (FGD) System offered by the Bidder shall be only from such manufacturer(s) who has previous experience of manufacturing and supplying the respective equipment(s) of the type, application and minimum equipment rating as stipulated below such that the respective equipment(s) should have been in successful operation in at least one (1) plant for a period not less than one(1) year as on 02nd Nov 2015

Name of Equipment	Type of Equipment	Application	Equipment Rating
Slurry Pumps	Centrifugal type	Wet Limestone based FGD application or ash slurry application in Coal fired power plant	Flow 50 m ³ /hr (minimum) with Head 30 Meters of Liquid Column (minimum)

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

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

DOCUMENT TO BE SUBMITTED ALONG WITH PART-I BID (SUB_QR QUALIFICATION DECLARATION) (This document to be addressed as Attachment-3K for Panki FGD)		
Bidder name with complete address :		
We declare that, we have designed,manufactured and supplied at least one (1) number of Slurry Pump of Capacity – Flow 50 m ³ /hr (minimum) with Head 30 Meters of Liquid Column (minimum), working in Wet Limestone based FGD application/ash slurry application in Coal fired power plant and which has been in successful operation for minimum one(1) year reckoned as on 2 nd Nov 2015, as per the details furnished below:		
Sl. No.	Description	Reference Work
1.	Name of the reference plant & location:	
2.	Client name and his address:	
3.	No. of units and capacity in MW of unit:	
4.	Whether operating in a Wet Limestone based FGD application in Coal fired power plant	*Yes/*No
5.	Name of Slurry Pump manufacturer & address:	
6.	Date of commission of the Slurry Pump:	
7.	Model no. of the Slurry Pump:	
8.	Brief Technical particulars of the Slurry Pump:	
9.	Capacity- Flow 50 m ³ /hr (minimum) with Head 30 Meters of Liquid Column (minimum)	Flow.....m3/hr , Head.....meters of Liquid Column
10.	Whether the Slurry Pump(s) are in successful operation in atleast one (01) plant for a period not less than one(01) year reckoned as on 02nd Nov 2015	*Yes/*No
11.	* Flue gas Desulphurization/ *Ash Handling system details:	*Technical extract/ *paper letter/ *email/ *Drawing from user or *contract document or *scheme or *any document in public domain enclosed at annexure....
12.	Scope of Work:	*Letter of Award or *Contract or *P.O. enclosed at Annexure.....
13.	Performance details:	*Certificate/*Letter/*E-mail from End user to be furnished by bidder

* Strike off whichever is not applicable

Bidder sign:

Bidder seal:

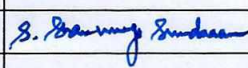
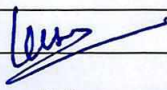
Date:



	BHARAT HEAVY ELECTRICALS LIMITED (A GOVT OF INDIA UNDERTAKING)	Flue Gas Desulphurization Group-FGD, Boiler Auxiliary Plant (BAP), Ranipet
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TECHNICAL SPECIFICATION FOR SLURRY PUMPS

SPECIFICATION NUMBER : FGD:SLP
BUYER (EPC) : BHEL, BAP Ranipet
APPLICATION : FLUE GAS DESULPHURIZATION SYSTEM

					
00	05-11-2019	Fresh Release	Arun Kumar	Shanmuga Sundaram S	V. Kesavan
REV	Date	Description	Prepared	Checked	Approved

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I. DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER:

Sl. No.	Description	Require For Part	Purpose
1.	Annexure to qualification requirements : Attachment -3K	I	Qualification Requirement (QR)
2.	Reference plant details of similar or higher capacity Slurry Pumps supplied (ANNEXURE-I)	I	QR
3.	Proforma Invoice of Supply	I	Consideration of Bid
4.	Proforma Invoice of Mandatory Spares	I	Consideration of Bid
5.	Proforma Invoice for Supervision of Erection & Commissioning	I	Consideration of Bid
6.	Seal & Sign of bidder on all pages of specification	I	Technical Evaluation of Bid(TEB)
7.	Deviation List (if any)	I	TEB
8.	Slurry Pump & Motor Sizing Calculation	I	TEB
9.	GA drawing including cross sectional view & BOM with total weight of all offered pumps	I	TEB
10.	P & ID diagram of Slurry Pumps & Lube oil system	I	TEB
11.	Filled Data Sheets of Slurry Pumps & All accessories	I	TEB
12.	Performance curves i. Flow v/s Head ii. Flow v/s NPSH iii. Flow v/s Efficiency iv. Flow v/s Power Consumption v. Torque v/s Speed curve for motor selection	I	TEB
13.	Required Electric power & other Utility List	I	TEB
14.	Make of all bought out items & sub vendor list	I	TEB
15.	Quality Plan	I	TEB
16.	List of Start-up & Commissioning Spares	I	TEB
17.	List of Special Tools	I	TEB
18.	Delivery Schedule	I	TEB
19.	Catalogue	I	TEB



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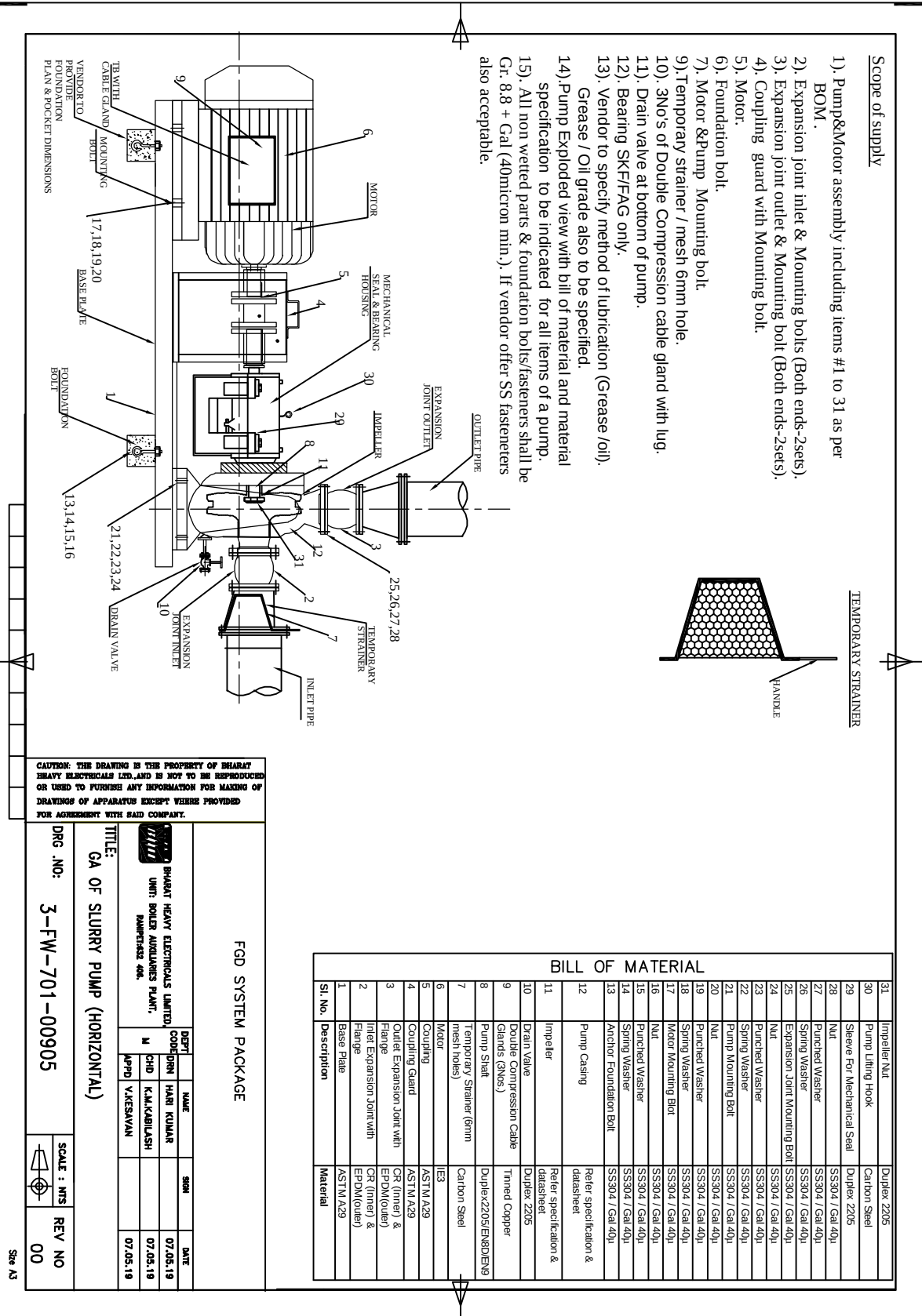
II. DOCUMENTS TO BE SUBMITTED AFTER CONTRACT:

Sl. No.	Description	Handing over of Documents after Contract (in weeks)	Purpose
1.	Utility Consumption & Lubricating Oil List	2	Customer Approval
2.	Foundation Drawing, Anchor Bolts, static & dynamic details	2	Customer Approval
3.	GA drawing including cross sectional view of Slurry Pumps & Accessories with bill of material (in PDF & Autocad format)	2	Customer Approval
4.	GA drawings for Pumps in series arrangement with interconnecting piping & expansion joints drawings	2	Customer Approval
5.	P&ID drawing of Slurry Pumps & Lube Oil System in PDF & AUTOCAD format	3	Customer Approval
6.	GA drawings of mechanical seal and coupling for offered slurry pumps	3	Customer Approval
7.	Filled Data Sheets of Slurry Pumps & All accessories	3	Customer Approval
8.	Quality Plan with Inspection & Performance Test Procedure at site	3	Customer Approval
9.	Pump & Motor Sizing Calculation	4	Customer Approval
10.	Performance curves i. Flow v/s Total Pressure ii. Flow v/s Efficiency iii. Flow v/s Power consumption iv. Torque v/s Speed curve for motor selection	4	Customer Approval
11.	Motor Rating in Kw	4	Customer Approval
12.	Sub vendors List	4	Customer Approval
13.	Manufacturing Schedule	4	Customer Approval
14.	Approximate weight of each skid	5	To arrange lifting
15.	List of Special Tools	8	E&C
16.	List of Start-up & Commissioning Spares	9	E&C
17.	Required Electric power	10	E&C
18.	Pre- Commissioning Check List	10	E&C
19.	Installation & assembly procedure	10	E&C
20.	Erection & Commissioning Schedule	10	E&C
21.	Recommended Repair Procedure	10	E&C
22.	Operation and Maintenance Manual (10 hardcopies and 5 electronic copies in English)	10	E&C
23.	Electrical Load List with Single Line Diagram	10	BHEL Review
24.	Control Logic of Slurry Pumps	10	BHEL Review
25.	Catalogue	10	BHEL Review
26.	Proforma Packing List	12	Dispatch

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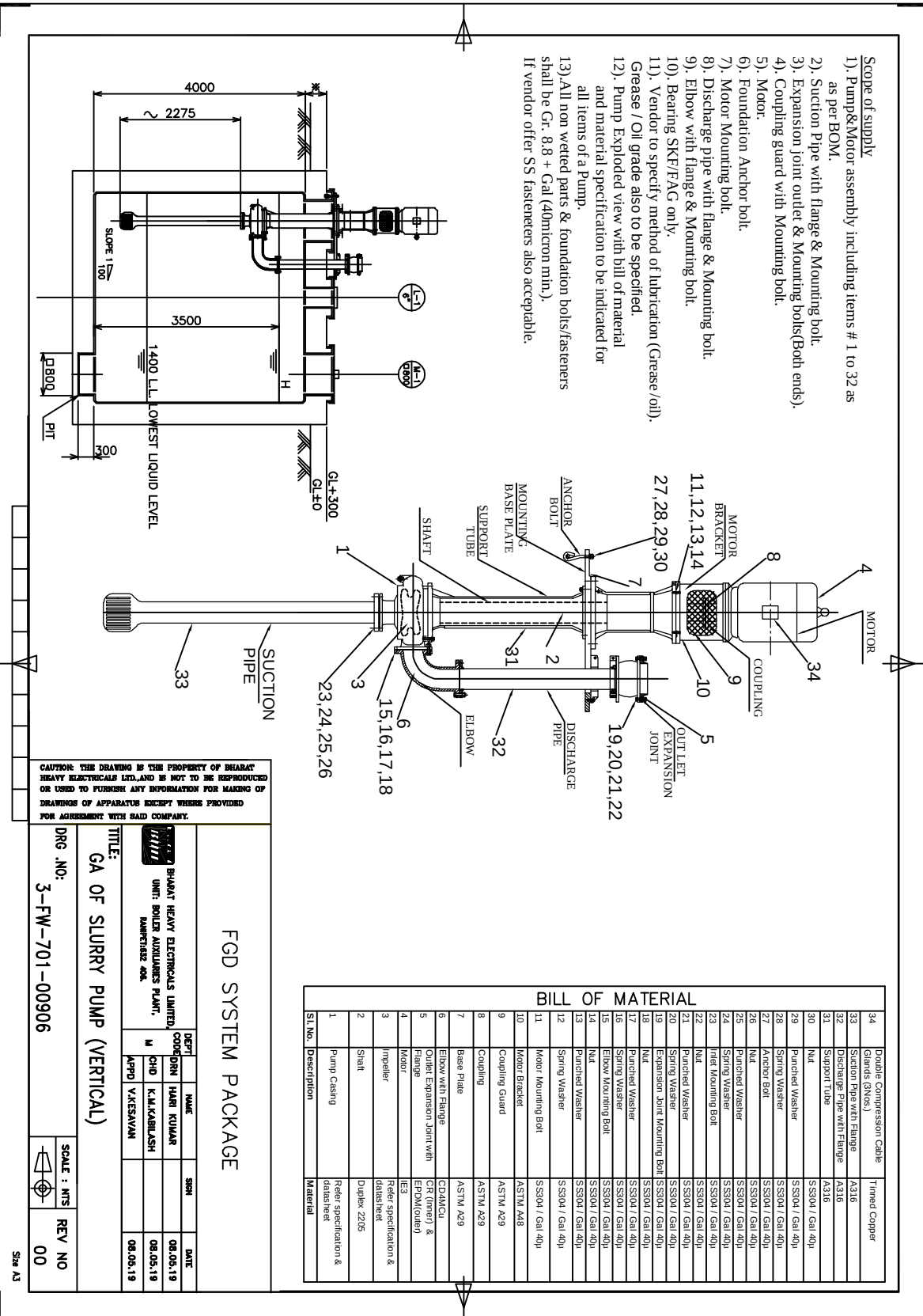
III. TYPICAL SLURRY PUMP (HORIZONTAL) DRAWING WITH BOM



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IV. TYPICAL SLURRY PUMP (VERTICAL) DRAWING WITH BOM



Bidder's Seal & Sign



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1.0 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 & commissioning and performance guarantee testing for the Flue Gas Desulphurization plant. The following points may be noted:

- a. Bidder shall assume full responsibility for the entire equipment assembly and make all possible efforts to comply strictly with the requirements of this specification and other specifications/attachments to inquiry/order.
- b. 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- II)".
- c. No deviation or exception shall be permitted without the written approval of the purchaser.
- d. 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.
- e. 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.
- f. 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.

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. If any other country standard used, then against each standard, equivalent Indian/Internal standard to be indicated against each item. A copy of such standard duly translated in English shall be furnished by vendor. In general, pumps shall conform to latest edition of the following standards:

- IS:1520 : Horizontal centrifugal pumps for clear cold fresh water
- IS:5120 : Technical requirements of roto dynamic special purpose pumps
- API:610: Centrifugal pumps for general refinery service
- IS:5639: Pumps handling chemicals & corrosion liquids
- IS:5659: Pumps for process water
- HIS: Hydraulic Institute Standards USA
- ASTM-1-165-65: Standard methods for Liquid Penetration Inspection

3.0 PROVENNESS CRITERIA:

The Bidder shall offer only proven design which meets the Provenness criteria indicated in the **QR requirement documents**. Necessary documentary evidences as per **Attachment-3K for qualification** shall be submitted along with the bid. If the bidder doesn't meet the specified provenances criteria, they are denied to participate in this tender.

Bidders are required to meet the Qualification Requirement (QR) for Slurry Pumps as per **enclosed document & submit Attachment-3K to qualification requirement**

4.0 MATERIAL OF CONSTRUCTION

	Material of construction	Horizontal Centrifugal Pump Id No. (1) To (8)	Vertical Sump Pump Id No. (9) To (11)
i.	Casing	1. Ductile Iron(65-45-12, ASTM A536) with replaceable rubber liner- 14000hrs to be guaranteed. OR 2. Ductile Iron with Hi Chrome liner - 14000hrs to be guaranteed. OR 3. Hi Chrome (ASTM 532 Grade IIIA) with minimum hardness of 600-650 BHN - 40000 hrs to be guaranteed for bare pump.	1. Ductile Iron(65-45-12, ASTM A536) with replaceable rubber liner- 14000hrs to be guaranteed. OR 2. Ductile Iron with Hi Chrome liner - 14000hrs to be guaranteed. OR 3. Hi Chrome (ASTM 532 Grade IIIA) with minimum hardness of 600-650 BHN - 40000 hrs to be guaranteed for bare pump.
ii.	Impeller	Hi Chrome or superior material with 14000 hrs guarantee.	Hi Chrome or superior material with 14000 hrs guarantee.
iii.	Solid Shaft	Duplex 2205 /EN8D /EN9	Duplex 2205
iv.	Shaft sleeve at mechanical seal	CD4MCU ASTM A 743/ Duplex 2205	CD4MCU ASTM A 743/ Duplex 2205
v.	Base Plate	Carbon steel	Carbon steel

5.0 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 CUSTOMER.

Supply: Includes manufacturing/fabrication, shop floor testing, stage inspections, final inspections, painting & packing.

Supervision of Erection & commissioning: Includes supervision of erection & commissioning, supervision of trial operation, training of customer's O&M Personnel.

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

Sl. No	Scope
1.	Slurry pump complete with
	i. Casing
	ii. Rotor and Shaft assembly
	iii. Drive motor as per specification
	iv. Coupling
	v. Common base frame and shock pads
	vi. Single Mechanical seal
	vii. Flushing and drain system
	viii. Coupling guards with bolts
	ix. Temporary Strainers required for commissioning
	x. Expansion joints at suction and Discharge
	xi. Casing drain terminated at battery limit with flange



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Sl. No	Scope
	xii. Cooling water piping for Bearing cooling(if applicable)
	xiii. Lubrication system
	xiv. Foundation bolts for supplied items
	xv. Pedestal
	xvi. Drip tray
	xvii. Lantern Ring
	xviii. In case of series pumps , common/individual base frame to be provided by vendor with interconnecting piping, interconnecting expansion joints & interconnecting fasteners.
	xix. Mechanical Running and Performance test at shop
	xx. Painting and Rust Prevention during shipment and construction
	xxi. Supervision of Erection & commissioning at site
	xxii. Special tools & tackles as applicable
	xxiii. Accessory Piping within the skid
	xxiv. First fill of consumables like chemicals, reagents, resins, lubricants, etc.,
	xxv. Start-up & Commissioning spares as applicable
	xxvi. Seaworthy Packing & Forwarding (for import supplies) to Project Site office
	xxvii. Installation, operation and maintenance manuals
	xxviii. Any other items required for completeness of the equipment except the items covered in the exclusions.

6.0	DESIGN & CONSTRUCTION
6.1	DESIGN REQUIREMENTS
1.	The pump shall be single stage centrifugal type capable of delivering the rated flow at rated head with margins as specified below.
2.	All slurry pumps for a particular service shall be identical and interchangeable.
3.	In case of series arrangement , both slurry pumps shall be identical and interchangeable.
4.	All the pump wear parts in contact with the slurry shall be provided with replaceable rubber/elastomer liners suitable for the fluid handled. The bidder can also offer an hi chrome alloy line pump if the bidder has previous experience of the same for similar applications.
5.	The design of the shaft shall ensure that the operating speed is at least 20% above the critical speed of the shaft.
6.	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(FAG/SKF)
7.	The Pump shall be capable of developing the required total head at rated capacity for continuous operation. Also the pumps shall be capable of being operated to give satisfactory performance at any point on the HQ characteristics curve. The operating range of the pump shall be 40% to 120% of the duty point unless otherwise mentioned elsewhere. The maximum efficiency of pump shall preferably be within $\pm 10\%$ of the rated design flow as indicated.
8.	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.
9.	Pumps of a particular category shall be identical and shall be suitable for parallel operation with equal load division. The head Vs capacity and BHP Vs capacity characteristics should match to ensure even load sharing and trouble free operation throughout the range. Components of identical pumps shall be interchangeable.



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10.	Pumps shall run smoothly without undue noise and vibration. Peak to peak vibration limits shall be restricted to the following values during operation. Pump speed shall not exceed 1500 RPM <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></table>	Speed	Antifriction Bearing	Sleeve Bearing	1500 rpm and below	75.0 micron	75.0 micron		
Speed	Antifriction Bearing	Sleeve Bearing							
1500 rpm and below	75.0 micron	75.0 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><22kW</td><td>125% of pump rated BkW</td></tr><tr><td>22kW-55kW</td><td>115% of pump rated BkW</td></tr><tr><td>>55kW</td><td>110% of pump rated BkW</td></tr></table>	Pump Rated BkW	Motor Rating	<22kW	125% of pump rated BkW	22kW-55kW	115% of pump rated BkW	>55kW	110% of pump rated BkW
Pump Rated BkW	Motor Rating								
<22kW	125% of pump rated BkW								
22kW-55kW	115% of pump rated BkW								
>55kW	110% of pump rated BkW								
12.	The kW rating of the drive unit shall be based on continuously driving the connected equipment for the conditions specified. However, in cases where parallel operation of the pumps are specified, the actual motor rating is to be selected by the Bidder considering overloading of the pumps in the event of tripping of operating pump(s).								
13.	Pumps shall be so designed that pump impellers and other accessories of the pumps are not damaged due to flow reversal.								
14.	The Contractor under this specification shall assume full responsibility in the operation of pump and motor as a unit.								
15.	The pumps shall be designed as impeller centrifugal pump. The pumps shall be wear-resistant, be equipped with flushing devices to prevent sedimentation and shall be designed and installed in a manner to allow easy replacements, repair and maintenance.								
16.	Single mechanical seals with flush less/ with flushing (refer data sheet) with a connection for additional manual flushing shall be applied.								
17.	Pumps shall have the rated capacity near the best efficiency point								
18.	Impellers shall be single piece casting. Fabricated impellers shall not be accepted.								
19.	The Pumps shall be wear resistant be equipped with flushing devices to prevent sedimentation and shall be designed and installed in a manner to allow easy replacements, repair and maintenance.								
20.	The slurry pumps shall be equipped with oil level indication, coupling guard and collecting equipment for leakage, made of resistant material.								
21.	Single mechanical seals with automatic flushing with a connection for additional manual flushing shall be applied.								
22.	All pumps shall be designed to withstand a test pressure of 200% of pump rated head or 1.5 times the maximum possible pump shut off pressure under maximum suction pressure conditions.								
23.	Process water flushing lines and drains are to be supplied for each pump handling the prevailing water to avoid corrosion if the pump is out of operation for extended periods.								
24.	Pumps must be carefully set to ensure that the net positive suction head available under all operating conditions will be adequate. The NPSH Values are to be referred to the least favorable operating conditions- lowest atmospheric pressure, lowest level of water on the suction side of the pump and highest temperature of the pumped fluid. An adequate safety margin of normally greater than 1m to the max NPSH required shall be provided.								
25.	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 15% higher								



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	than the duty point head.
26.	All pumps shall be fitted with discharge pressure gauges
27.	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.
28.	Pumps shall have stable head-capacity characteristics curve from run-off to shut-off.
29.	Selection of Duty point should preferably be at BEP (Best Efficiency Point) or slightly at the left of BEP. Selection point beyond 110% of BEP will not be acceptable. It should be noted that head variation is due to level variation in tank. Pump has to run in the system without compromising its NPSH requirement at lowest water level in tank. Hence, when tanks are filled-up and is at normal water level, pump will operate at the right of BEP, pump's operating zone should be considered accordingly.
30.	External flushing is required to remove the accumulated particles and all related information should be mentioned in data sheet.
31.	Pump should have adjustment provision of axial clearance between casing and impeller for maintenance of performance at best efficiency when there is wear in between impeller and casing.
32.	Each pump will have a coupling of adequate size, designed for full load and capable of supporting start-up an overload moment. Each half of the coupling will be factory mounted and locked to its shaft. The coupling must be able to accept the adjustment of the impeller.
33.	The Antifriction bearing of the pumps shall be designed for minimum useful life (L-10) of 20,000 hours of continuous operation (Under the design condition). The thrust bearing will have dimensions for a minimum of 175 % of the required load.
34.	The pumps shall have mechanical seals of cartridge type with self-lubrication sliding ring cartridges. The static part will be mounted on the seal plate with circumferential ring (O-ring) or another flexible sealing ring. Built in seal design will not be accepted.
35.	The sealing areas shall be designed in such a way so that solids do not precipitate in them affect the cooling or affect the adjustment and mechanical functioning of the seals. Seals which do not need jet cleaning are preferred.
36.	Pump induced vibration due to flow pulsations shall be avoided through suitable design.
37.	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).
6.2	CONSTRUCTIONAL FEATURES
A)	CASING
a.	Pumps shall be of Radial Split Casing, Close/Semi-open, Over-hang, End Suction Type Back Pull-out design, Vertical Discharge type for Horizontal Centrifugal Pump.
b.	The casing shall be designed to withstand the maximum shut-off pressure developed by the pump at the pumping temperature.
c.	Pump casing shall be provided with a vent connection and piping with fittings & valves. Casing drain as required shall be provided complete with drain valves, piping and plugs.
d.	Pump casing to be provided with a connection for discharge pressure gauge as standard feature. It shall



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	be structurally sound to provide housing for the pump assembly and shall be designed hydraulically to minimum radial load at part load operation.
e.	Lifting provision of pump as a whole and individual casing half should be provided.
f.	Renewable wear rings shall be provided at points of running clearance and shall be made from appropriate materials.
B)	IMPELLER
a.	Impeller shall be closed, semi-closed or open type and designed in conformance with the detailed analysis of the liquid being handled. The impeller shall be secured to the shaft, and shall be retained against circumferential movement by keying, pinning or lock rings. On pumps with overhung shaft, impellers shall be secured to the shaft by a lockout or cap screw which tightness in the direction of normal rotation.
b.	Tip speed of impeller (i) for rubber lined pumps should not exceed 25m/sec, (ii) for other pumps should not exceed 30m/sec .
c.	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
d.	Impeller as rotating assembly along with all elements should be dynamically balanced according to ISO 1940
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)	IMPELLER/CASING WEARING RINGS
a.	Replaceable type wearing rings shall be provided at suitable locations of pumps. Suitable method of locking the wearing ring shall be used. Wearing rings shall be provided in pump casing and/or impeller as per manufacturer's standard practice.
D)	SHAFT
b.	The shaft shall be ground and polished to final dimensions and shall be adequately sized to withstand all stresses from rotor weight, hydraulic loads, vibration and torques coming in during operation.
c.	All Pump shafts shall be of ample size to transmit the maximum possible output from the prime mover.
d.	The pump shaft and coupling are to be so dimensioned that the maximum permissible torque of the shaft is higher than the maximum transmissible torque of the coupling and gear.
e.	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.
f.	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.
g.	Shaft shall run in high precision heavy duty roller bearings. Lubrication system provided shall be such that visual checking of lubricant level is possible
h.	The shaft shall be finished to close tolerance at the rotor, coupling and bearing diameters. The size of shaft shall be calculated on the basis of maximum combined shear stress. This shear stress shall not exceed 30 percent of the elastic limit in tension or 18 percent of ultimate tensile strength.



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i.	No parts of the shaft should come in contact with the liquid medium for horizontal centrifugal pump.
j.	Shaft should have a keyed joint at impeller hub. No thread connection between impeller and shaft is acceptable.
E)	SHAFT SLEEVES
a.	Renewable type fine finished shaft sleeves shall be provided at mechanical seals. Shaft sleeves shall be fastened to the shaft to prevent any leakage or loosening. Shaft and shaft sleeve assembly should ensure concentric rotation.
F)	BEARINGS
a.	Heavy duty bearings, adequately designed for the type of service specified in the enclosed pump data sheet and for long, trouble free operation shall be furnished. The bearings offered shall be capable of taking both the radial and axial thrust coming into play during operation. In case, sleeve bearings are offered additional thrust bearings shall be provided. Antifriction bearings of standard type (SKF/FAG) shall be selected for a minimum life 20,000 hrs. of continuous operation at maximum axial and radial loads and rated speed. Proper lubricating arrangement for the bearings shall be provided. The design shall be such that the bearing lubricating element does not contaminate the liquid pumped. Where there is a possibility of liquid entering the bearings suitable arrangement in the form of deflectors or any other suitable arrangement must be provided ahead of bearings assembly. Bearings shall be easily accessible without disturbing the pump assembly. A drain plug shall be provided at the bottom of each bearings housing.
b.	The bearings may be ball, roller or sleeve bearing. If sleeve bearings are used these shall be machined for close running fit. The bearings shall be designed to take the necessary radial load as well as the net axial thrust. Bearings shall be lubricated properly and sized for an operating life of 20,000 hours on the basis of maximum load. Oil level indication shall be provided.
c.	The bearings shall be of automatic oil lubricated type. Vibration sensors and temperature measurements incl. temperature transmitter for continuous monitoring shall be provided.
d.	Bearing housings on horizontal shaft pumps shall be designed to enable the bearings to be replaced without removing the pump or motor from its mounting. Bearing housings on horizontal shaft pumps shall be effectively protected against the ingress of water, pumped fluid and dust by suitable nonferrous deflectors.
e.	If bearing housing requires cooling water, volume and pressure of cooling water is to be indicated in Technical Data Sheet.
f.	Lubricating oil will be the responsibility of pump manufacturer. Hence, manufacturer has to make arrangement of first fill of oil at installation, and at commissioning stage. Quantity of oil and its grade is to be indicated in Drawing and Operation Manual.
G)	MECHANICAL SEALS
a.	Mechanical seals shall be of single type with either sliding gasket or bellows between the axially moving face and shaft sleeves or any other suitable type. 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.	The pump supplier shall coordinate with the seal maker in establishing the seal chamber of circulation rate for maintaining a stable film at the seal face. The seal piping system shall form an integral part of the pump assembly. For the seals under vacuum service, the seal design must ensure sealing against



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	atmospheric pressure even when the pumps are not operating. Necessary provision for seal water supply along with complete piping fittings and valves as required shall form integral part of pump supply.
c.	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.
d.	Design the mechanical seals chamber to have sufficient room to lubricate and get seal face cool with its own slurry.
e.	Provide requirements for periodical flushing to rinse the seal face for leaked slurry.
f.	Pump shall be supplied with mechanical seal. All mechanical seals, regardless of type or arrangement, shall be of the cartridge design. Hook sleeve cartridge should not be used.
g.	Requirement of flushing water, its quantity, and pressure to be indicated in data sheet.
h.	Zero leakage is the intension of this specification. However, quantity of leakage, if it is unavoidable, pump should have a provision of collecting of any drip leakage and flushing the same to nearby pit is to be providing without corroding the base plate of pump.
i.	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
j.	Intention of the specification is not to specify Type of Seal, Seal design, Spring configuration, Seal configuration, Balanced or Unbalance type etc. Pump manufacturer to decide the same along with seal manufacturer the best seal that is suitable for the offered pump.
k.	Seal life has to be guaranteed, taking into consideration all its components for 25000 hrs. If the seals fail before the completion of guaranteed period, the same should be replaced free of cost by the bidder.
H)	COUPLING
a.	The pump and motor shafts shall be connected with an adequately sized flexible coupling of proven design with a spacer to facilitate dismantling of the pump without disturbing the motor. Necessary coupling guards shall also be provided.
b.	Coupling halves shall be machine matched to ensure accurate alignment. Couplings and gears must have a rated capacity of at least 120% of the maximum potential power transmission requirement.
c.	Coupling shall be of flexible type made of cast steel. The Bidder shall furnish both halves of the coupling. Both the Coupling halves shall be bored and keyed to fit shafts of the gearbox and the motor by bidder.
d.	All rotating parts such as coupling shall be covered with suitable protective guards. Guards shall be easily removable type. If weight of the coupling is heavy (>40 kgs), provision of tapped hole should be incorporated in right place of hub to handle the same effortlessly
I)	BASE PLATE
a.	A common base plate mounting both for the pump and motor shall be furnished. The base plate shall be fabricated steel and of rigid construction, suitably ribbed and reinforced. Base plate and pump supports shall be so constructed and the piping unit so mounted as to minimize misalignment caused by mechanical forces such as normal piping strain, internal differential thermal expansion and hydraulic piping thrust. Suitable drain troughs and drip lip shall be provided.
b.	In case of series pumps, common base plate for both pump or individual for each pump also acceptable.
c.	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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d.	Base plate must have provision of aligning driver and driven shaft in both directions of base plate so that shafts can be aligned. Similarly, provision must be provided for alignment of shaft in vertical plane.
e.	Pump manufacturer is to supply base plate along with Foundation bolt & Nut, "Taper wedge" and the necessary fastener for Pump and Motor with Base plate.
f.	Base plate must be provided with a trough, material of which must be compatible of pumping liquid. Leaked liquid, collected in trough, can be systematically routed at designated point
g.	Base plate must be stress-relieved for any residual welding stress and certificate to that effect is to be submitted as per inspection requirement.
J)	ASSEMBLY AND DISMANTLING
i.	Assembly and dismantling of each pump with drive motor shall be possible without disturbing the grouting base plate or alignment.
K)	ADDITIONAL REQUIREMENT FOR VERTICAL SUMP PUMP
	The pumps shall be designed for continuous operation. The pump shall be single stage centrifugal type with semi open or open impeller . The pump impeller shall be cantilever type and shall not be supported below the base plate for easy withdrawal.
	The pump shall deliver the rated flow at rated head with margins as specified in the respective clauses. The pump shall be capable of pumping of slurry with solid concentration upto 30 wt% & particle lumps of 6-7mm.
	The material chosen for the pump components shall be suitable for the fluid handled and shall be proven in similar application.
	The pumps shall not be supported below the base plate level for easy withdrawal without entering the sump.
M)	ACCESSORIES:
1.	Expansion Joints:
i.	Expansion Joints shall be provided at suction and discharge of each pump. In case of series pumps, expansion joints shall be provided in between the pumps also along with connecting piping & all accessories.
2.	Suction Strainers
i.	Temporary conical strainer to be provided so as to avoid entry of any troublesome particle into the pump at the time of commissioning/starting up. Note: Pipe sizes/Flange sizes will be informed during detail engineering for deciding strainer size & its mounting holes.

6.3 Motor

This specification generally covers the requirement for motors involved in Slurry Pumps system package.

6.3.1 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	



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6.3.2 Degree of protection:

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

6.3.3 General requirements:

S.No	Parameters	Requirements	
1	Direction of rotation	Suitable for both directions	
2	Winding Insulation	The winding insulation process shall be Global Vacuum Pressure Impregnated i.e. resin poor method	
3	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)	
4	Starting voltage requirement	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	
5	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.	
6	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.	
7	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 h. 90 to 125Kw	Vendor's standard 85 115 167 196 249 277 331
8	Cable glands & Lugs	Double compression type Nickel plated brass cable gland & insulated tinned copper crimping lugs to suit the cable sizes	
9	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	

6.3.3 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



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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

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 in which these are proposed to operate.
5.	Noise level produced by any rotating equipment individually or collectively shall not exceed 85 dB measured at a distance of 1.0 meter horizontally from the source in any direction and 1.5m above operating floor. Predicted sound pressure levels for the pump drive assemblies shall be submitted as part of the proposal data.
6.	The overall vibration level shall be as per ISO 10816.
7.	Suitable drain connections shall be provided.
8.	The equipment shall be suitable for stable operation continuously.
9.	Limit of connection: The buyer (BHEL) has an intention to minimize interface for utilities as much as possible. The bidder shall consider this requirement in the planning stage of layout for the equipment. The bidder shall provide the header piping for utilities and branch piping to each nozzle. Terminal points for all utilities shall be located at skid edge. The bidder shall specify all terminal points with tie-in number in the P&ID and submit it in the proposal to confirm the scope of supply.
10.	Service life: Entire equipment except wearing parts shall be designed and fabricated for a minimum service life of 30 years of operation or 200,000 full load operating hours whichever is longer.
11.	Corrosion allowance: Corrosion allowance for entire equipment shall be in accordance with latest applicable Indian / International standard.
12.	Unless otherwise specified , flanges shall be in accordance with ANSI B16.5 Class 150
13.	Name plate: All equipment shall be provided with nameplates indicating the item number and service name. Name plates shall be of 304 Stainless steel plate and placed at a readily visible location. Nameplate of main equipment shall have enough information, which will be confirmed during engineering phase. Stainless steel nameplates for all instruments and valves shall be provided.
14.	Rotation arrows shall be cast in or attached with stainless steel plate on each item of rotation equipment at a readily visible location.
15.	Unless otherwise specified, all equipment items where the weight exceeds 15 kg shall be provided with suitable lifting lugs, ears or ring bolts or tapped holes for lifting rings. Minimum shock factor for lifting lugs shall be minimum 2.0. The position of lifting lugs and reference dimension shall be shown on GA and/or outline drawings. NDT shall be conducted for lifting lugs. When any spreader bars are required



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S. No.	Description
	for lifting and laydown, the bidder shall provide spreader bar with equipment.
16.	Skid Mount/Transportation: Equipment shall be fabricated as skid mount design as much as practical to minimize erection at the site.
17.	Two pieces of stainless steel earth lugs shall be provided with equipment diagonally. The position of earth lugs shall be shown on each GA and/or outline drawing.
18.	Provide double nuts for anchor bolts
19.	Bidder shall provide allowable vibration level on foundation in foundation drawings and/or general arrangement drawings.
20.	If the driver/driven equipment train is in the resonance condition or any vibration problems occur, the bidder shall solve the problems in a timely manner.
21.	Bidder shall provide the mating flanges with the necessary gaskets.
22.	All the surfaces of the carbon steel should be rust prevented before shipment for the period of at least 12 months for storage and construction.
23.	Bidder to provide capacity of crane or hoist required for material handling and the details of heaviest component to be handled.
24.	The list of all Bought out items with makes and country of origin to be mentioned along with offer to be submitted.
25.	Quality Plan to be submitted along with the offer.
26.	Cost towards the participation in discussions/meetings, providing technical assistance during technical discussions/meetings with customer for approval of drawing/documents etc. TA/DA, boarding and lodging to attend these meetings shall be borne by the bidder and shall be inclusive in supply portion.
27.	Material of construction for all equipment/components shall be subject to CUSTOMER/ BHEL approval during detail engineering. Accordingly bidder shall consider MOC for all equipment/component as per best engineering practice, global standard and global references.
28.	Bidder to provide sub vendor list and Bidder shall strictly adhere to CUSTOMER approved vendor list. In case bidder proposes an additional vendor for an item or vendor approval is required for any new item, acceptance shall be subject to approval by CUSTOMER/ BHEL before placing order and bidder shall submit relevant documents as per enclosed Attachment Sub-Supplier Questionnaire .
29.	It shall be the complete responsibility of the successful bidders to obtain "Sub Vendor Approval" from BHEL / CUSTOMER for all equipments & components. Any delay in sub vendor's approval should not affect the project schedule. If any of the sub vendors does not have the approval of CUSTOMER/ BHEL, the same may be replaced with another CUSTOMER/BHEL approved sub-vendor only, without any price implications to BHEL.
30.	The modalities of inspection (Stage, Final, In-process) shall be finalized during detail engineering after submission of quality assurance plan (QAP). It shall be reviewed by the CUSTOMER/ BHEL. Bidder shall follow the procedures of inspection as per the approved QAP. Bidder has to submit the following documents along with inspection call and if any other documents required as per approved QAP. - Raw material inspection certificate - Internal test reports - Statutory certificates as required.



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S. No.	Description
	- All inspection & testing shall be carried out based on the following documents: a. Relevant Standards b. Specifications c. Approved drawings d. Data Sheets e. Calibration certificate for all the measuring instruments f. Bidder should also coordinate in getting the MDCC's (Material Dispatch clearance certificate) and all types of IC's (Inspection Certificates) from the CUSTOMER along with BHEL.
31.	Minor Chipping i.e. up to 50 mm thk, micro leveling and providing shim plates for erection of equipment / item at site shall be in the scope of bidder.
32.	During detail engineering, bidder to strictly adhere to BHEL/CUSTOMER drawing formats, document numbering, quality plan & FQP formats
33.	The identification and numbering of equipment, systems, items, etc. of supply, as well as of all documents and drawings shall be in accordance with reference Designation System for Power Plants - KKS system.
34.	Complete detail engineering drawings, calculations, selection of components etc. shall be reviewed & subject to approval of BHEL/CUSTOMER during detail engineering
35.	Bidder shall furnish necessary inputs & drawings of all equipment in editable Auto CAD/ MS-Word /Excel format.
36.	During detail engineering, successful bidder shall ensure flow of drawings/documents as per schedule. Any comments from BHEL/CUSTOMER should be addressed timely by the bidder.
37.	Bidder to note that list above is not exhaustive and any work /items required for completing the smooth operation and ensuring satisfactory running of the machines till final hand over to the end user shall also be in the scope of the bidder.
38.	Bidder shall submit the signed and stamped copy of all the pages which constitutes this technical enquiry specification signed by authorized signatory and clearly mentioning each clause under following two categories to avoid any ambiguity in scope understanding & the scope division along with technical offer. a. "Accepted without deviation and considered in scope of work" b. "Not considered in scope of work"
8.0	PACKING AND FORWARDING
1.	Proper packing to be ensured. Indigenous Supply: Pump & sub system assembly shall be wrapped in polythene bags & packed in a strong rigid wooden crate. Rain water should not enter into the pump internals during storage in the outer yard of power plant. Imported Supply: All imported supply should be packed as per Sea worthy packing specification no. PT-TS-888-100-A001 .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



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S. No.	Description
	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 (CUSTOMER).
5.	Packaging or shipping units shall be designed within the limitations of the unloading facilities of the receiving ports and the ship will be used. It shall be the bidder's responsibility to investigate these limitations and to provide suitable packaging and shipping to permit transportation to site.
6.	Packing (tare) shall be part of the equipment cost and shall not be subject to return. The packing should ensure integrity and cohesiveness of each delivery batch of equipment during transportation. In case of equipment assemblies and unit's delivery in the packing of glass, plastics or paper the specification of packing with the material and weight characteristics are to be indicated.
7.	Each package should have the following inscriptions and signs stenciled with an indelible ink legibly and clearly: a. Destination b. Package Number c. Gross and Net Weight d. Dimensions e. Lifting places f. Handling marks and the following delivery marking
8.	Each package or shipping units shall be clearly marked or stenciled on at least two sides with project details as per enquiry. In addition, each package or shipping unit shall have the symbol painted in red on at least two sides of the package, covering one fourth of the area of the side.
9.	Each part of the equipment which is to be shipped as a separate piece or smaller parts packed within the same case shall be legibly marked to show the unit of which it is part, and match marked to show its relative position in the unit, to facilitate assembly in the field. Unit marks and match marks shall be made with steel stamps and with paint.
10.	Each case shall contain a packing list showing the detailed contents of the package. When any technical documents are supplied together with the shipment of materials no single package shall contain more than one set of such documents. Shipping papers shall clearly indicate in which packages the technical documents are contained.
11.	The case number shall be written in the form of a fraction, the numerator of which is the serial number of the case and the denominator the total number of case in which a complete unit of equipment is packed.
12.	Wherever necessary besides usual inscriptions the cases shall bear special indication such as "Top", "Do not turn over", "Care", "Keep Dry" etc. as well as indication of the center of gravity (with red vertical lines) and places for attaching slings (with chain marks)



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S. No.	Description
13.	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)
14.	Each crate or package is to contain a packing list in a waterproof envelope. All items are to be clearly marked for easy identification against the packing List. All cases, packages etc. are to be clearly marked on the outside to indicate the total weight where the weight is bearing and the correct position of the slings are to bear an identification mark relating them to the appropriate shipping documents. All stencil marks on the outside of cases are either to be made in waterproof material or protected by shellac or varnish to prevent obliteration in transit.
15.	The packing slip shall contain the following information: - Customer name, Name of the equipment, Purchase Order number with Date, Address of the delivery site, Name and Address of the Sender, Serial Number of pump & accessories, BHEL item Code, Gross Weight and Net weight of Supplied items.
16.	Prior to transport from manufacturer's work to destination, components of the unit shall be completely cleaned to remove any foreign particles. Flange faces and other machined surfaces shall be protected by an easily removable rust preventive coating followed by suitable wrapping.
17.	All necessary painting, corrosion protection & preservation measures shall be taken as specified in painting schedule. Supplier shall consider the coastal environment zone which is defined as "very severe" during final finishing/shipping.
18.	Successful bidder shall furnish the detail packing /shipment box details with information like packing box size, type of packing, weight of each consignment, sequence no. of dispatch, no. of consignment for each deliverable item against each billing break up units/ billable blocks. Without these details the BBU shall not be approved during detail engineering. Also, complete billing break-up with above mentioned details shall be submitted within 10days of LOI.
19.	All items/equipment shall be dispatched in properly packed condition (i.e. no item shall be dispatched in loose condition such that it becomes difficult to store/identify its location at site at a later stage).
20.	Cases which cannot be marked as above shall have metal tags with the necessary markings on them. The metal tags shall be securely attached to the packages with strong steel binding wire. Each piece, Skid, Case or package shipped separately shall be labelled or tagged properly.
9.0	SUPERVISION OF ERECTION, TESTING AND COMMISSIONING
1.	The erection of Slurry Pumps will be done by owner as per Erection Manual and check List. However, the bidder shall make 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.
2.	Number of visits and number of days per visit for Supervision shall be as per indent/enquiry.
3.	TA/DA, boarding and lodging shall be borne by the bidder and shall be inclusive in supply portion.
4.	Per day Charges for supervision shall be quoted by the bidder.



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S. No.	Description
5.	Price comparison for evaluating the lowest bid will be considered all main supply, supervision of E&C charges and mandatory spares price all together.
10.0	EXCLUSION
	The following work associated with the slurry pump will be by BHEL: a. Civil foundations b. Walkways, platforms and ladders c. Element handling hoists
11.0	INSPECTION AND TESTING
A)	Minimum Testing requirements to be considered are as below:
1.	Hydrostatic test is to be conducted at 200% of pump rated head or at 150% of shut off head, whichever is higher for duration of 30 minutes, taking into consideration of the fact that actual operating temperature is 65 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- Spark test, Shore Hardness, Class and Type certificate
5.	UT on shaft forgings (greater or equal to 40mm) and MPI/DPT shall be done on shafts and impeller to ensure freedom from defects.
6.	Once mounting is finished and operation less will be conducted on each pump to determine the characteristic curves. For dynamic pressure and volume output, and to determine the parameters at the design point, mechanical running & performance testing shall be performed & witnessed.
7.	The pump rotating parts shall be subjected to static and dynamic balancing.
8.	NPSH Test, Vibration test and Noise level test shall be witnessed at shop.
9.	For surfaces with rubber lining Welding shall be visually inspected to verify the absence of rough area and unacceptable transition between surfaces which prevent the adequate adherence of rubber. The acceptance criteria shall be as per latest standard.
10.	For surfaces with rubber lining, degree of cleaning shall be visually checked before the application of the coating. There must be no area with oxidation, dirt or partially or generalized corrosion defects.



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S. No.	Description
11.	Test certificates shall be issued for each lot of raw material used in the coating, corresponding to specific weight and traction resistance.
12.	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.
13.	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 / CUSTOMER prior to manufacture. Inspection of above mentioned tests by BHEL/ CUSTOMER 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/CUSTOMER.
3.	Slurry Pumps will 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 remaining pumps and submit the reports.
5.	A dynamic balancing certificates stating that the rotating assembly has been balanced dynamically shall be sent to CUSTOMER/ BHEL within one (1) week of the successful completion of balancing.
6.	Acceptance tolerance of actual versus guaranteed performance for capacity, head, efficiency and power absorbed shall be as per applicable standard.
7.	Vibration levels shall be measured during shop running/performance tests.
8.	Contract shaft seals shall be used during shop tests, unless the seal design is unsuitable for the shop-test condition.
9.	Slurry 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 at factory. 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.
12.0	PAINTING – As per enclosed document
13.0	SPARES,TOOLS & TACKLES



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S. No.	Description
13.1	START UP & COMMISSIONING SPARES
	Start-up & Commissioning Spares shall be part of the main supply of the Slurry 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.
13.3	SPECIAL TOOLS & TACKLES:
	Any special tools & tackles required for the entire equipment to disassemble, assemble or maintain the units, they shall be included in the quotation and furnished as part of the initial supply of the machine. List of special tools & tackles shall be decided by bidder as per his proven practice. When special tools are provided, they shall be packaged in separate, boxes with lugs and marked as "Special Tools for (tag / item number)." Each tool shall be stamped or tagged to indicate its intended usage. Levers and eye bolts for the removal of parts to be serviced shall be submitted with special tools.
14.0	PERFORMANCE GUARANTEE
	All performance tests for Slurry 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 Slurry pump 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% for 120 days and average target availability of 95% for 1 year. 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 which shall be submitted for BHEL/ CUSTOMER 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.
15.0	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 the offer.
2.	BID EVALUATION CRITERIA FOR POWER CONSUMPTION: Power loading shall be applicable for slurry pumps designated as "continuous duty condition" in enclosed pump datasheet. Lowest value of the power consumption quoted by any bidder shall be taken as the base value. In case, Guaranteed Shaft power offered by the bidder exceeds the base value specified above, his bid price will be loaded for excess power consumption as per the formula given below.



TECHNICAL SPECIFICATION OF SLURRY PUMPS

FGD:SLP:R00

S. No.	Description
	Adjustment factor for excess power consumption in INR = (GPC-BV) X PL X No's of Working pumps GPC- Guaranteed Power Consumption quoted by bidder in KW BV- base Value i.e. lowest quoted power consumption in KW PL- Power Loading @ 140,000 INR/KW
16.0	LIQUIDATED DAMAGES FOR POWER CONSUMPTION
	1. If actual Power Consumption at motor input terminal 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 = (APC-GPC) X P X No's of Working pumps Where • GPC- Guaranteed Power Consumption quoted by bidder in KW • APC- Actual Power Consumption in KW • P- Penalty @ 140,000 INR per KW Note : LD will be levied after conducting performance test as above subjected to the maximum 10% of the main equipment value. LD will be adjusted from the pending bills payable to the bidder. 2. For conducting PG test at project site for demonstrating the guaranteed parameters of pump, vendor has to make own arrangement for TA/DA and hotel charges, which is to be considered while submitting the offer.
17.0	WARRANTY
1.	The warranty period shall begin on the date of taking over by CUSTOMER or date of issuance of the provisional acceptance certificate for the unit (whichever occurs first) and shall end after twenty-four (24) months. Provided that the successful bidder shall extend the provisions of this warranty to cover all repaired and replacement parts furnished under the warranty obligations hereunder, subject to the warranty period for the same being for a period of 24 months from the date on which replacement or renewal work is completed.
2.	In case of failure of the equipment to meet the guarantee, CUSTOMER/BHEL reserves the right to reject the equipment. However, CUSTOMER/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 also include supply and filling of all chemicals, reagents, resins, lubricants, grease, filters and consumable items for operation up to commissioning including top up requirements. All lubricants proposed for the plant operation shall be suitable for all operating and environmental conditions that will be met on site consistent with good maintenance procedures as instructed in the maintenance manuals.



TECHNICAL SPECIFICATION OF SLURRY PUMPS

FGD:SLP:R00

S. No.	Description
2.	Detailed specifications for the lubricating oil, grease, gases, servo fluids, control fluids, chemicals including items qualities and quantities required per month of the plant operation for the CUSTOMER/BHEL's approval herein shall be furnished within 2 months of placement of Order. On completion of erection complete list of bearings/equipment giving their location and identification marks shall be furnished to BHEL along with lubrication requirements. All types of chemicals, consumables, lubricants and grease shall be readily obtainable locally and the number of different types shall be kept to a minimum. For each type and grade of lubricant recommended, bidder shall list at least three equivalent lubricants manufactured by alternative companies.
19.0	TRAINING
	Successful bidder shall provide comprehensive training for CUSTOMER/BHEL Engineering, O&M, Erection & Commissioning staffs at site covering all aspects of the Slurry pumps - Operation & Maintenance, Troubleshooting etc. (for minimum 2 days).
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 CUSTOMER 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.
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. The documents mentioned as to be submitted along with the offer 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 all documents, mentioned as to be submitted after award of contract, for review, approval. Drawings that are reviewed by the CUSTOMER/ 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. CUSTOMER/ BHEL reserves the right to return drawings unprocessed to bidder if there exists any evidence that bidder has not acknowledged all comments and questions. All necessary GA drawings, sections, sub-assembly drawings, specifications of main and sub components and necessary set of operation & maintenance manual as asked by CUSTOMER must be furnished by bidder in soft and hard copy forms. For all documents softcopy format shall be searchable pdf, however in addition all drawings, diagrams like P&IDS shall be supplied in ACAD or other editable format and all lists in Excel format. Further break up of technical documents will be discussed during finalization of the purchase contract. Unless agreed otherwise, ten (10) hard copies and five (05) sets of electronic copies of all documents are to be submitted in the English language. Electronic Copies shall be submitted in primary original data format (e.g. DOC, XLS, DWG) as well as in a printable non-proprietary document format (e.g. PDF).



TECHNICAL SPECIFICATION OF SLURRY PUMPS

FGD:SLP:R00

S. No.	Description
	Especially P&IDs shall be submitted as DWG files and PDF files. Bidder to ensure submission of hard copies as per CUSTOMER 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.

22.0 LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED:

The following type test reports shall be submitted for each type and rating of

LT motor of above 50 KW only

1. Measurement of resistance of windings of stator and wound rotor.
2. No load test at rated voltage to determine input current power and speed
3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors)
4. Full load test to determine efficiency power factor and slip.
5. Temperature rise test.
6. Momentary excess torque test.
7. High voltage test.
8. Test for vibration severity of motor.
9. Test for noise levels of motor:
 - Noise level for all the motors shall be limited to 85dB (A) except for BFP motor for which the maximum limit shall be 90 dB(A). Vibration shall be limited within the limits prescribed in IS/IEC 60034-14. Motors shall withstand vibrations produced by driven equipment. Motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.
10. Test for degree of protection
11. Over speed test.
12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1
 - All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.
 - The type test reports once approved for any projects shall be treated as reference. For subsequent projects of CUSTOMER, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.

SIGNATURE OF BIDDER

NAME

DESIGNATION



TECHNICAL SPECIFICATION OF SLURRY PUMPS

FGD:SLP:R00

ANNEXURE I : REFERENCE LIST FOR SLURRY PUMPS

Sl.No.	Project Name , Customer & Plant capacity	Coal fired Yes/No	Wet Limestone Based FGD Yes/No	Type of Slurry Pump	Model	Capacity	Head in meter of slurry column	Speed	Year of Com mg	Qty
						m ³ /hr.	meter	rpm		

SIGNATURE OF BIDDER -----

NAME -----

DESIGNATION -----



TECHNICAL SPECIFICATION OF SLURRY PUMPS

FGD:SLP:R00

ANNEXURE II : LIST OF DEVIATIONS/EXCEPTIONS TO THE ENQUIRY DOCUMENT

Enquiry No : _____; Project : _____

SI No	Clause No	Page No	Description of Deviation

Note: Enlarge the table to incorporate items

SIGNATURE OF BIDDER _____

NAME _____

DESIGNATION _____

[illegible]

Project Name:-----

Pump Vendor Details : _____

Enquiry no. -----

Motor Manufacturer : -----

LT MOTOR DATA SHEET FOR SLURRY PUMPS

DE-1	LT MOTORS	1 Limestone Slurry feed pump	2 Gypsum Bleed pump	3 Pri.Hy. feed tank pump	4 Filtrate water pump	5 Sec.Hy. feed tank pump	6 Waste water pump	7 Aux.absr tank pump	8 Emerge -ncy tank pump	9 Absorber area drain sump pump	10 Gypsum area drain sump pump	11 Limestone Mill area drain sump pump
A.	GENERAL											
1.	Quantity (as per enquiry)											
2.	Motor Manufacturer & Country of origin.											
3.	Motor type											
B.	DESIGN AND PERFORMANCE DATA											
1.	Frame size											
2.	Type of duty	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	
3.	Type of enclosure / Method of cooling/ Degree of protection											
4.	Applicable standard to which motor generally conforms											
5.	Efficiency IE3 of IS 12615 or above (vendor to fill up efficiency here)											
6.a	Whether motor is flame proof	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
6.b	If yes, the gas group to which it conforms as per IS:2148	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	

BIDDER'S SEAL & SIGN:

TO BE FILLED & ATTACHED ALONG WITH TECHNICAL OFFER
(incomplete filling of data sheet liable to rejection of offer)

Project Name:-----

Pump Vendor Details : _____

Enquiry no. -----

Motor Manufacturer : -----

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)	415	415	415	415	415	415	415	415	415	415	
13	Permissible variation of :											
13.	Voltage (Volts)											
13.	Frequency (Hz) (+3% to -5%)- vendor to specify											
13.	Combined voltage and frequency 10% -vendor to specify											
14	Rated speed in RPM (at rated voltage and frequency)											
15	At rated Voltage and frequency:											
15.a	Full load current											

BIDDER'S SEAL & SIGN:

TO BE FILLED & ATTACHED ALONG WITH TECHNICAL OFFER
(incomplete filling of data sheet liable to rejection of offer)

Project Name:-----

Pump Vendor Details : _____

Enquiry no. -----

Motor Manufacturer : -----

15.b	No load current											
16	Power Factor at											
16.a	100%/75%/50% load											
16.b	NO load											
16.c	Starting.											
17	Efficiency at rated voltage and frequency,											
17.a	100% load											
17.b	75% load											
17.c	50% load											
18	Starting current (amps) at											
18	100 % voltage											
18	85% voltage											
18.c	80% voltage											
19	Minimum permissible starting Voltage (Volts) 85% of rated voltage upto 110KW , 80% above 110kw											
20	Starting time with minimum permissible voltage/80%/ 100%/ 110%											

BIDDER'S SEAL & SIGN:

TO BE FILLED & ATTACHED ALONG WITH TECHNICAL OFFER
(incomplete filling of data sheet liable to rejection of offer)

Project Name:-----

Pump Vendor Details : _____

Enquiry no. -----

Motor Manufacturer : -----

20.a	Without driven equipment coupled											
20.b	With driven equipment coupled											
21	Safe stall time with 100% ,110% & 80% of rated voltage											
21.a	From hot condition											
21.b	From cold condition											
22	Torques :											
22.a	Starting torque at min. permissible voltage(kg-mtr.)/ rated voltage											
22.b	Pull up torque at rated voltage											
22.c	Pull out torque											
22.d	Min accelerating torque (kg.m) available at lowest permissible starting voltage should be 10% of rated torque											
22.e	Rated torque (kg.m)											
23	Stator winding resistance per phase (ohms at 20 Deg.C.)											
24	GD2 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											

BIDDER'S SEAL & SIGN:

TO BE FILLED & ATTACHED ALONG WITH TECHNICAL OFFER
(incomplete filling of data sheet liable to rejection of offer)

Project Name:-----

Pump Vendor Details : _____

Enquiry no. -----

Motor Manufacturer : -----

28	Vibration limit :Velocity (mm/s)											
29	Noise level limit (dBA)											
C.	CONSTRUCTIONAL FEATURES											
1.	Stator winding insulation											
1.a	Class & Type (minimum155 F)											
1.b	Winding Insulation Process											
1.c	Tropicalised (Yes/No)											
1.d	Temperature rise over specified maximum ambient temperature of 50 deg C											
1.e	Method of temperature measurement											
1.f	Stator winding connection											
2	Main Terminal Box											
2.a	Type											
2.b	Location(viewed from NDE side)											
2.c	Entry of cables(bottom/side)											

BIDDER'S SEAL & SIGN:

TO BE FILLED & ATTACHED ALONG WITH TECHNICAL OFFER
(incomplete filling of data sheet liable to rejection of offer)

Project Name:-----

Pump Vendor Details : _____

Enquiry no. -----

Motor Manufacturer : -----

2.d	Recommended cable size(To be matched with cable size envisaged by owner)											
2.e	Fault level (MVA),Fault level duration(sec)											
2.f	Cable glands & lugs details (shall be suitable for power cable recommended by motor vendor (vendor scope)											
3	Type of DE/NDE Bearing											
4	Motor Paint shade	RAL 5012 Blue	RAL 5012 Blue	RAL 5012 Blue	RAL 5012 Blue	RAL 5012 Blue	RAL 5012 Blue	RAL 5012 Blue	RAL 5012 Blue	RAL 5012 Blue	RAL 5012 Blue	
5	Weight of											
5.a	Motor stator (KG)											
5.b	Motor Rotor (KG)											
5.c	Total weight (KG)											
D.	List of accessories.											
1.	Space Heaters (Nos./Power in watts/supply voltage) for motor 30KW and above											
2.	Terminal Box for Space Heater (Yes/No)											
3.	Speed switch (Yes/No) No of contacts and contact ratings of speed switch											

BIDDER'S SEAL & SIGN:

TO BE FILLED & ATTACHED ALONG WITH TECHNICAL OFFER
(incomplete filling of data sheet liable to rejection of offer)

Project Name:-----

Pump Vendor Details : _____

Enquiry no. -----

Motor Manufacturer : -----

4.	Insulation of bearing (Yes/No)											
5.	Noise reducer(Yes/No)											
6.	Grounding pads											
6	No and size on motor body											
6	Nos on terminal Box											
7.	Any other fitments											
E.	List of curves. (All curves to be attached along with offer)											
1	Torque speed characteristic of the motor (enclosed yes / No)											
2	Thermal withstand characteristic ((enclosed yes / No)											
3	Starting. current Vs. Time ((enclosed yes / No)											
4	Starting. current Vs speed (enclosed yes / No)											
5	P.F. and Effi. Vs Load (enclosed yes / No)											

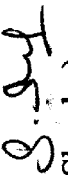
BIDDER'S SEAL & SIGN:

TO BE FILLED & ATTACHED ALONG WITH TECHNICAL OFFER
(incomplete filling of data sheet liable to rejection of offer)

LT MOTOR APPROVED VENDORS ARE GIVEN BELOW. HT MOTORS TO BE SOURCED FROM BHEL/ABB/SIEMENS

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

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

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

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

	CORPORATE QUALITY ASSURANCE SUB-VENDOR QUESTIONNAIRE
---	---

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

	CORPORATE QUALITY ASSURANCE SUB-VENDOR QUESTIONNAIRE
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10.	Quality Control exercised during receipt of raw material/BOI, in-process , Final Testing, packing	Details attached at Annexure – F2.6
11.	Manufacturing facilities (List of machines, special process facilities, material handling etc.)	Details attached at Annexure – F2.7
12.	Testing facilities (List of testing equipment)	Details attached at Annexure – F2.8
13.	If manufacturing process involves fabrication then-	Applicable / Not applicable
	List of qualified Welders	Details attached at Annexure – F2.9
	List of qualified NDT personnel with area of specialization	(if applicable)
14.	List of out-sourced manufacturing processes with Sub-Vendors' names & addresses	Applicable / Not applicable Details attached at Annexure. –F2.10 (if applicable)
15.	Supply reference list including recent supplies	Details attached at Annexure – F2.11 (as per format given below)

Project/ package	Customer Name	Supplied Item (Type/Rating/Model /Capacity/Size etc)	PO ref no/date	Supplied Quantity	Date of Supply

16.	Product satisfactory performance feedback letter/certificates/End User Feedback	Attached at annexure - F2.12
17.	Summary of Type Test Report (Type Test Details, Report No, Agency, Date of testing) for the proposed product (similar or higher rating) Note:- Reports need not to be submitted	Applicable / Not applicable Details attached at Annexure – F2.13 (if applicable)
18.	Statutory / mandatory certification for the proposed product	Applicable / Not applicable Details attached at Annexure – F2.14 (if applicable)
19.	Copy of ISO 9001 certificate (if available)	Attached at Annexure – F2.15
20.	Product technical catalogues for proposed item (if available)	Details attached at Annexure – F2.16

Name:		Desig:		Sign:		Date:	

Company's Seal/Stamp:-

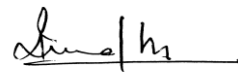
Annexure to Enquiry no:		Date
Sl.No	BHEL / Customer Requirement	##Specific confirmations by the manufacture
1	Quality Plan Requirement:	
	(i) MQP (Manuafcutering Quality Plan) shall be submitted in attached format for BHEL/Customer review & approval. Typical MQP is attached for indicative purposes for guidance & use.	
	(ii) MQP shall invariably cover w.r.t Inward inspection including on Raw materail Procurement, In process and Final inspection in elaborated way/details.	
	(iii) Bidder shall also to give specific confirmation that on need basis, their competent officials shall visit to BHEL/customer for finalization of Quality plan including test procedure/methodology during preaward / post award approval / detailed engineering in the event of an order.	
	(iv) No deviation on BHEL/Customer approved MQP is acceptable.	
	(v) Bidder shall agree to submit all cross referred documents other than codes/standrads to BHEL/Customer/Consultant.	
	Important Notes shall be included in MQP : (a) Latest revision of Standard s & Specification shall apply. Only International Standards are applicible. Indian & Chinese Standards are not applicable (b) Materials shall be procured in compliance to Functional Technical Specification. (c) Inspection shall be in compliance with Approved Quality Control Procedure for the Product. (d) NDT shall be carried out by Qualified Personnel with compliance to Approved NDT Procedures and Acceptance Norms, as per ASME Section V. (e) Gauges and measuring Instruments, with valid calibration only shall be used. (f) Cleaning and Painting of products shall be carried out as per Approved Painting Schedule. (g) Finished Products shall be packed to comply with Approved Packing Schedule. (h) Welding shall be carried out by Qualified Personnel with compliance to Approved NDT Procedures and Acceptance Norms, as per ASME Section V.	
2	Domaetic / Inland Inspection will be carried out by BHEL/BHEL apointed Third Party Inspection Agency (TPIA) / Customer/Customer Apointed Inspection Agency/Consulatnat. This is applicable for all Stage inspection and Final Inspection identified as "W" - Witness or "CHP" - Customer Hold Point as per customer approved Quality Plan/ Technical specification / Approved Drawing/ Approved Data sheet / Scheme / PID / PFD / SLD (Process Instrumentaion Diagram / Process Flow Diagram / Single Line Diagram) etc (As applicable).	
3	Inspection Agency for Foreign Bidders and also for Indian Bidder but importing from Forgign Sources : (1) Any one of the flollowing Third Party Inspection Agency (TPIA) shall be appointed by the bidder and same shall be furnished by the bidder in techno commercial bid itself. (2) The details of TPIA with contact details like Name of the official, Phone no, Email id shall also to be submitted during pre/post award. However cost for such inspection agency shall be borne by the bidder only. Inspection charges for such inspection agency shall be indicated separately so that if BHEL/Customer is undertaking the inspection by on their own , then these charges non claimable by the bidder. List of TPIA 1. M/s Bureau Veritas 2. M/s TUV-Nord 3. M/s TUV-SUD 4. M/s TUV Rheinland 5. M/s Lloyds Register 6. M/s SGS 7. M/s Germanischer Lloyds 8. M/s QUEST 9. M/s Certification Engineers International 10. M/s Intertek 11. M/s IR Class Systems and Solutions 12. M/s DNV 13. M/s Fichtner 14. M/s ABS Inspection Services	
4	Stage Inspection during manufacturing Process : Stage Inspection during manufacturing shall be carried out as per approved quality plan and all necessary documents shall be provided for review,verification and clearanace for further processing. This inspection call shall be given well in advance (atleast 2 weeks before) to TPI/Bidder's own inspection agency to avoid delay in the manufacturing processes.	

Sl.No	BHEL / Customer Requirement	##Specific confirmations by the manufacture
5	Inspection before despatch for domestic supplier : Inspection before despatch at supplier's works shall be carried out by BHEL/BHEL appointed Inspection agency. Inspection shall be done as per approved Quality plan/ Technical specification/ Approved Drawing/ Approved Data sheet .	
6	Inspection at Foreign Source/Supplier: (a) As in sl no: 3. shall be ensured without fail (b) No materail / items shall be despatched without getting the written communication from BHEL / Customer inspection carried out by BHEL/BHEL apointed Third Party Inspection Agency (TPIA) / Customer/Customer Apointed Inspection Agency/Consulatnat. This is applicable for all Stage inspection and Final Inspection identified as "W" - Witness or "CHP" - Customer Hold Point as per customer approved Quality Plan/ Technical specification / Approved Drawing/ Approved Data sheet / Scheme / PID / PFD / SLD (Process Instrumentaion Diagram / Process Flow Diagram / Single Line Diagram) etc (As applicable). Inspection before despatch for Foreign supplier : Inspection before despatch at supplier's works shall be carried out by bidder appointed inspection agencies having international presence at vendors and or vendor's sub vendor works. Inspection shall be done as per approved Quality plan/ Technical specification/ Approved Drawing/ Approved Data sheet by TPIA mentioned in SI no: 03 at supplier's cost.	
7	Painting shall be done strictly as per BHEL/Customer approved painting schedule / scheme only. Paint Thickness / Paint shade shall be ensured as per BHEL / Customer approved painting schedule / specification / data sheet etc. No deviation is acceptable unless otherwise accepted by BHEL/Customer in writing. Any conflict if any among BHEL / Customer approved painting schedule / Spec / data sheet etc shall be brought to the notice to BHEL well in adavnce before proceding including the BOI being procured for assy / skid like motors etc	
8	Specific conformation for document package in the event of an order (2 Hard copies & soft copy in PDF file) is to be given containing the following with proper linkages (i) Index Sheet (ii) MQP/RQP/Endorsement Sheet (As applicable) (iii) TCs identified by BHEL/ Customer for record for "CHP" / "W" and Verification portion ("V") as given in approved QP. (iv) Final inspection report + TC including Chemical + Mechnaical + HT + NDT etc (v) Third party Inspection report + TC (vi) Customer CHP/ MDCC (vii) Type test / Performance Test reports conducted (viii) Type test / Performance Test approval/ clearance obtained from BHEL/Customer (ix) BOM with As Build Drgs with actual make / rating used with BHEL/customer approved drawings.	
9	Packing / Seaworthy Packing shall be as per BHEL Packing schedule / approved drg / sketch. This shall be ensured to take care tarnsit / handling / transhipment in Road / Sea / Air. Photographs are to be submitted for BHEL review before despatching the material as per contract conditions.	
10	Outsourcing of test facilities: Bidder shall ensure all the testing facilities in house. However If any of the test facilities are not available with successful bidder, then bidder shall ensure the same at NABL accreadted third party lab / Govt / Govt Lab for major testing such as NDT, Electrical & Mechanical testing.	
11	Important Note: No deviation on the above requirement 01 to 10 is acceptable w.r.t Quality Requirement and those offers not meeting these specific customer requirement is liable for rejection and hence the bidder shall submit all the required documentary evidances in the offer itself.	
12	## Necessorily to be filled up by the bidder at the time of offer itself otherwise the offer may not be considered w.r.t Quality Requirement being customer specific requirement.	

SAMPLE QUALITY PLAN

 Ranipet		MANUFACTURER'S NAME AND ADDRESS M/S BHEL: BAP: RANIPET 632 406 TAMIL NADU		STANDARD QUALITY PLAN										
				ITEM: SLURRY PUMP SYSTEM: FGD					QP NO		FGS:724			
									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.

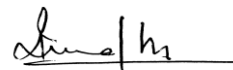
1.0 RAW MATERIAL														
1.1	a) Volute Casing b) Wear Plate c) Impeller	Chemical & mechanical properties	Major	Composition analysis & mechanical properties test	1 Per Heat No	Approved GA Drawing / Data Sheet		Raw Material TC/COC	√	P	V	V	Tensile Test Is Applicable For Volute Casing Only.	
1.2	Shaft	1)Chemical Composition 2)Mechanical Properties	Major	Composition analysis & mechanical properties test	1 Per Heat No	Approved GA Drawing / Data Sheet		Material Test Report	√	P	V	V		
		UT Test	Major	NDT	100%	ASTM A 388	ASME Sec V	Test Report	√	P	V	V	Shafts Ø40mm are UT tested.	
2.0 IN PROCESS INSPECTION														
2.1	Impeller	Surface Defect	Major	DPT on machined surfaces	100%	ASTM E 165	ASME Sec V	Insp Report	√	P	V	V		
	Shafts after machining	Surface Defect	Major	DPT	100%	ASTM E 165	ASME Sec V	Insp Report	√	P	V	V		
2.2	Impeller & Shaft	Residual Unbalance	Major	Static & Dynamic Balancing	100%	Relevant Standard/ISO 1940 Gr 2.5		Insp Report	√	P	V	V		
2.3	Casing	Soundness	Major	Hydrostatic test	100%	No leakage		Insp Report	√	P	V	V	At 200% Of Pump Rated	

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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 Ranipet		MANUFACTURER'S NAME AND ADDRESS M/S BHEL: BAP: RANIPET 632 406 TAMIL NADU		STANDARD QUALITY PLAN										
				ITEM: SLURRY PUMP SYSTEM: FGD						QP NO		FGS:724		
										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.
														Head Or 150% Of Shut Off Head, Whichever Is Higher, for at least 30min.
2.4	Motor	Make, Type, Rating	Major	Visual	100%		Approved Drawing / Data Sheet	Routine Test Report/COC	√	P	V	V		Motor Up to 30kw COC Will Be Provided.
3.0 FINAL INSPECTION														
3.1	Complete Pump	Dimensions	Major	Measurement & Visual	100%		Manufacturer Drawing	Inspection Report	√	P	W	W		
3.2	Performance Test	1)Flow, Head, Efficiency, BHP at Rated Speed 2)Vibration and Noise Level 3)Leakage Test	Major	Measurement & Visual	100%	1/mod el	Approved Drawing / Data Sheet	Insp Report	√	P	W **	W*		
		Strip Down Test Not Required If Performance Test Is Fine	Major	Visual	100%	1/mod el	Mfg. Drawing, Approved Data Sheet		√	P	W	W		Only Required in Case of Abnormal Sound

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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)

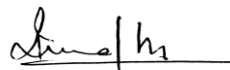
 Ranipet		MANUFACTURER'S NAME AND ADDRESS M/S BHEL: BAP: RANIPET 632 406 TAMIL NADU		STANDARD QUALITY PLAN										
				ITEM: SLURRY PUMP SYSTEM: FGD						QP NO		FGS:724		
										REV. NO:		00		
										DATE:		12.02.2019		
								PAGE NO:		Page 3 of 3				
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
					M	C/N					M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D*	** 10.			11.
3.3	Painting Check	DFT, Paint Shade	Major	Measurement And Visual	100%	Rando m	Approved Painting scheme	Insp Report	√	P	W	V	Quality Dossier To Be Submitted Finally.	

NOTE:

1. For Slurry Pump Motor Rating is 37KW and motor make NTPC/BHEL Approved source.
2. Routine test report duly witnessed by main contractor as per applicable standard shall be reviewed during inspection (more than 30KW Rating).

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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)

Bharat Heavy Electricals Limited

Ranipet-632406, India.

Quality Assurance(Mech)

To,

Shri. V Raghupathy, SM/FGD-Purchase

BAP: QA: Panki : Slurry Pump: 76

Kind Attn: Shri M Venkateswarlu, Mgr/QA

Dt. 25-11-2019

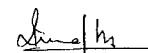
Ref: ENGG SPEC: FGD: SLP: R00

INDENT No: (RFW90607, Rev: 00), (RFW90609, Rev: 00), (RFW90610, Rev: 00) Dated
19.11.2019

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

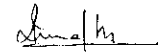
Quality department comments as follows:

1. Inspection and testing shall be done as per approved Quality plan, Quality plan to be approved by Customer (NTPC).
2. Painting shall be as per approved Painting schedule.
3. As Slurry Pumps for Panki 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 NTPC /QA also.
4. Arrange MQP from sub QR Cleared vendor for taking up with NTPC for their approval. Find herewith-attached sample MQP (SQP NO.FGS:724/00, DT: 12.02.2019). This MQP is indicative only and actual Quantum of Check/Stage may differ based on Project/Customer requirement.
5. All the Slurry Pumps will be inspected at supplier works as per approved QP/Approved Drawing/Approved datasheet and Specification.
6. Annexure 'Q' shall be part of enquiry File.
7. For Motor Purchase shall ensure following requirements:
 - Motor shall be procured from NTPC Approved Sources.



R K Madhu
Dy. Mgr(QA)

- For Motor rating up to 30 KW Inspection by BHEL/BHEL TPI as per BHEL approved QP applicable and after inspection of BHEL TPI Motor, routine test shall be submitted to BHEL for review and record.
- For Motor rating more than 30KW and up to 50KW, Inspection by BHEL/BHEL TPI as per NTPC approved QP applicable and after inspection of BHEL TPI Inspection report including Motor routine test shall be submitted to NTPC for review and inspection clearance.
- For Motor rating above 50KW, Inspection by BHEL and NTPC applicable as per NTPC approved QP.

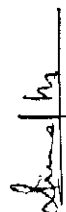


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Dy. Mgr(QA)

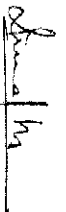
STANDARD QUALITY PLAN										
MANUFACTURER'S NAME AND ADDRESS			ITEM: SLURRY PUMP SYSTEM: FGD				Qp NO: FGS:724			
M/S BHEL: BAP: RANIPET 632 406 TAMIL NADU							REV. NO: 00			
							DATE: 12.02.2019			
							PAGE NO: Page 1 of 3			
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS
1.	2.	3.	4.	5.	M C/N	7.	8.	9.	M C N	11.

1.0 RAW MATERIAL										
1.1	a) Volute Casing b) Wear Plate c) Impeller	Chemical & mechanical properties	Major	Composition analysis & mechanical properties test	1 Per Heat No	Approved GA Drawing / Data Sheet		Raw Material TC/COC	✓	Tensile Test Is Applicable For Volute Casing Only.
1.2	Shaft	1)Chemical Composition 2)Mechanical Properties	Major	Composition analysis & mechanical properties test	1 Per Heat No	Approved GA Drawing / Data Sheet		Material Test Report	✓	
		UT Test	Major	NDT	100%	ASTM A 388	ASME Sec V	Test Report	✓	Shafts Ø40mm are UT tested.

2.0 IN PROCESS INSPECTION										
2.1	Impeller	Surface Defect	Major	DPT on machined surfaces	100%	ASTM E 165	ASME Sec V	Insp Report	✓	
	Shafts after machining	Surface Defect	Major	DPT	100%	ASTM E 165	ASME Sec V	Insp Report	✓	
2.2	Impeller & Shaft	Residual Unbalance	Major	Static & Dynamic Balancing	100%	Relevant Standard/ISO 1940 Gr 2.5		Insp Report	✓	
2.3	Casing	Soundness	Major	Hydrostatic test	100%	No leakage		Insp Report	✓	At 200% Of Pump Rated

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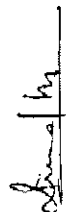
MANUFACTURER'S NAME AND ADDRESS			STANDARD QUALITY PLAN											
 M/S BHEL: BAP: RANIPET 632 406 TAMIL NADU Ranipet			ITEM: SLURRY PUMP SYSTEM: FGD					QP NO			FGS:724		REMARKS	
								REV. NO:			00			
								DATE:			12.02.2019			
								PAGE NO:			Page 2 of 3			
S.L. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			
1.	2.	3.	4.	5.	M	C/N	7.	8.	9.	D*	** 10.	11.		
2.4	Motor	Make, Type, Rating	Major	Visual	100%		Approved Drawing / Data Sheet			✓	P	V	V	Head Or 150% Of Shut Off Head, whichever Is Higher, for at least 30min. Motor Up to 30kw COC Will Be Provided.
3.0 FINAL INSPECTION														
3.1	Complete Pump	Dimensions	Major	Measurement & Visual	100%		Manufacturer Drawing			✓	P	W	W	
3.2	Performance Test	1)Flow, Head, Efficiency, BHP at Rated Speed 2)Vibration and Noise Level 3)Leakage Test	Major	Measurement & Visual	100%		Approved Drawing / Data Sheet			✓	P	W	W*	
		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

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	Rakesh Kumar Madhu,(Ser/QA)	K C Gandhi Parimalam,(DGM/QA)

STANDARD QUALITY PLAN												
 Ranipet		MANUFACTURER'S NAME AND ADDRESS M/S BHEL: BAP: RANIPET 632 406 TAMIL NADU				ITEM: SLURRY PUMP SYSTEM: FGD						
						QP NO		FGS:724				
						REV. NO:		00				
						DATE:		12.02.2019				
PAGE NO:		Page 3 of 3				FORMAT OF RECORD		AGENCY		REMARKS		
SL. NO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	9.	D*	M	C	N
1.	2.	3.	4.	5.	6.	7.	8.	9.	D*	** 10.		
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