

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

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

CLAUSE NO.	INTENT OF SPECIFICATION			
	Bidder shall offer and supply only the type of the above equipment(s) for which he himself or the manufacturer proposed by the bidder for the above equipment(s) is qualified. The provenness criteria for equipment (Booster Fans) stipulated at Sl. No. 4.01.01 (a) above shall also be considered acceptable provided the rating parameters (i.e., flow, head and rated rpm) is covered within the operating regime of the respective fan performance curve of the reference plant equipment.			
4.01.02	In case the Bidder or the proposed sub-vendor is not manufacturer of proven Booster Fans as per clause 4.01.01 (a) above but is a manufacturer of such equipment for units of at least 500 MW rating, the Bidder or the proposed sub vendor can manufacture such equipment for 660 MW units also, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such equipment in India with such manufacturer who meet the requirements stipulated at clause 4.01.01 (a) above for the Booster Fans.			
4.01.03	A JV / Subsidiary Company formed for manufacturing and supply of equipment(s) as listed at clause no. 4.01.01 above in India, can also manufacture such equipment(s), provided that it has a valid collaboration or licensing agreement for design, engineering, manufacturing of such equipment(s) in India with a qualified equipment manufacturer who meets the requirements stipulated at clause 4.01.01 above (or the technology provider of the qualified equipment manufacturer) for the respective equipment(s). Before taking up the manufacturing of such equipment(s), the bidder/ his sub-vendor(s) must create /have created manufacturing facilities at his works as per collaborator's/licenser's design, manufacturing and quality control system for such equipment(s). Further, in such a case, such qualified equipment manufacturers should have, directly or indirectly through its holding company/ subsidiary company, at least 26% equity participation in the Indian Joint Venture Company/ Subsidiary Company, which shall be maintained for a lock-in period of seven (7) years from the date of incorporation of such Joint Venture/ Subsidiary or upto the end of defect liability period of the contract, whichever is later.			
4.01.04	In case the Bidder or the proposed sub-vendor is not manufacturer of proven Oxidation Blowers as per clause 4.01.01 (c) above but is a manufacturer of Blowers/compressors for minimum 50 NM ³ /min capacity, the Bidder or the proposed sub-vendor can also manufacture Oxidation Blowers, provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such Oxidation Blowers in India with such manufacturer who meet the requirements stipulated at clause 4.01.01 (c) above for the Oxidation Blowers. Before taking up the manufacturing of such equipment, the bidder/ his sub-vendor must create /have created manufacturing facilities at his works as per collaborator's /licenser's design, manufacturing and quality control system for such equipments.			
4.01.05	(i) In case the Bidder or the proposed sub-vendor is not manufacturer of proven Wet limestone Grinding mills as per clause 4.01.01 (d) above but is a manufacturer			
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-0011-109-(1A)2	SUB-SECTION-I INTENT OF SPECIFICATION	PAGE 8 OF 19

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

CLAUSE NO.	INTENT OF SPECIFICATION	एनटीपीसी NTPC	
	provided it has collaboration or valid licensing agreement for design, engineering, manufacturing, supply of such equipment in India with such manufacturer who meet the requirements stipulated at clause 4.01.01 (e) above for the Slurry Recirculation Pumps. Before taking up the manufacturing of such equipment, the bidder/ his sub-vendor must create /have created manufacturing facilities at his works as per collaborator's /licenser's design, manufacturing and quality control system for such equipment.		
4.01.08	Before taking up the manufacturing of such equipment(s) as per clause 4.01.02, 4.01.03, 4.01.04, 4.01.05(i), 4.01.06 & 4.01.07 above, the Bidder / its sub vendor(s) must create (or should have created) manufacturing and testing facilities at its works as per Collaborator / licenser's design, manufacturing and quality control system for such equipments duly certified by the Collaborator / licensor. Further, the Collaborator / Licenser shall provide (or should have provided) all design, design calculation, manufacturing drawings and must provide (or should have provided) technical and quality surveillance assistance and supervision during manufacturing, erection, testing, commissioning of equipments.		
4.01.09	Bidder shall offer and supply only the type of the above equipment(s) for which it, itself or the manufacturer / Collaborator(s) / Licenser(s) proposed by the Bidder for the above equipment(s) is qualified.		
4.01.10	The Employer reserves the right to fully satisfy himself regarding capability and capacity of Bidder / its sub-vendor(s) and the proposed arrangement and may prescribe additional requirement before allowing manufacture of the equipment listed above for this contract.		
	Note to clause 4.01.01 (1) Whenever the term 'coal fired' is appearing above, "Coal" shall be deemed to also include bituminous coal/brown coal/Anthracite Coal/lignite.		
4.02.00	Sub QR for Civil Works:		
4.02.01	Bidder or its agency should have in past executed civil and structural works for 500 MW or higher capacity coal based/Lignite based power plant including earthwork in filling involving mechanical compaction and cutting in hard rock, foundations, Bulk material handling plant involving underground storage hopper and underground tunnels.		
4.02.02	Bidder can engage more than one agency, in case the Bidder itself is not able to meet the requirement at 4.02.01. The agency being engaged for a particular work should have in the past executed such works of 500 MW or higher capacity plant.		
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-0011-109-(1A)2	SUB-SECTION-I INTENT OF SPECIFICATION
			PAGE 10 OF 19

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

Bidder's Name and Address:

To
Contract Services-II
NTPC Limited
Noida-201301

Summary of Critical Equipment indicated under clause 4.01.00, sub-section-I, Part-A of Section-VI.

Equipment Name	Sub-Vendor Name	Collaborator's Name, if applicable	Seeking Qualification as per clause..... Sub-Section-I, Part-A of Section-VI
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~~Booster Fans~~ ~~*4.01.01/*4.01.02/*4.01.03~~

~~*Slurry Recirculation Pumps~~ ~~*4.01.01/*4.01.03/*4.01.07~~

~~Oxidation Blowers~~ ~~*4.01.01/*4.01.03/*4.01.04~~

~~Wet limestone Grinding mills~~ ~~*4.01.01/*4.01.03/*4.01.05 (i)/4.01.05 (ii)~~

Slurry Pumps

~~Agitators~~ ~~*4.01.01/*4.01.03/*4.01.06~~

~~Vacuum Belt filters~~ ~~*4.01.01/*4.01.03~~

Note : *Strike-off whichever is not applicable.

1. If qualification sought as per clause 4.01.01, sub-section-I-A, Part-A of Section-VI then the details of the sub vendor (manufacturer) shall be filled by the bidder in the format A to G

ATTACHEMENT 3K
Page 2 of 98

2. If the qualification sought as per the clause 4.01.02, sub-section-I-A, Part-A of Section-VI, then the details of proposed sub vendor (i.e manufacturer of such equipments for at least 500 MW unit rating) shall be filled individually by the bidder in the format A and the details of collaborator who meets the requirement stipulated at 4.01.01, sub-section-I-A, Part-A of Section-VI shall also be filled by the bidder in the format A separately. Further, in case of qualification vide clause 4.01.02, sub-section-I-A, Part-A of Section-VI a copy of valid ongoing collaboration and technology transfer agreement for design, engineering, manufacturing, supply of such equipment in India with the collaborator who meets the requirement stipulated at 4.01.01, sub-section-I-A, Part-A of Section-VI shall also be furnished.
3. If the qualification sought as per the clause 4.01.03, sub-section-I-A, Part-A of Section-VI then the details of JV/Subsidiary Company formed for manufacturing of such equipments in India shall be furnished individually for each equipment by the bidder such as,
 - i) Copy of document of incorporation of JV/Subsidiary company in India
 - ii) Copy of valid ongoing collaboration and technology transfer agreement for design, engineering, manufacturing, supply of such equipment in India with the collaborator who meets the requirement stipulated at 4.01.01, sub-section-I-A, Part-A of Section-VI.
 - iii) Copy of document of at least 26% equity participation of qualified equipment manufacturer in the Indian JV company/subsidiary company directly or indirectly through its holding company /Subsidiary company, which shall be maintained for a lock -in period of seven (7) years from the date of incorporation of such JV/subsidiary or up to the end of defect liability period of the contract which ever is later.

Further, the details of collaborator or technology provider of the qualified equipment manufacturer who meets the requirement stipulated at 4.01.01, sub-section-I-A, Part-A of Section-VI shall be filled by the Bidder in the format A to G (format given at 1.00.00). In addition to that, the sub vendor along with the Indian JV company/subsidiary company, qualified equipment manufacturer and its holding company/subsidiary company as applicable shall furnish the DUJ.

*** strike out whichever is not applicable.**

- 1.00.00 (Applicable for Bidder/his sub vendors seeking qualification as per clause no. 4.01.01, Sub section-I, Part-A of Section-VI. Bidder shall furnish the required data only for those equipments / auxiliaries which are proposed to be sourced under this route.)

We, hereby furnish the data on proveness criteria for critical equipment, auxiliaries, systems and Bought Out Items such as Booster Fans, *Slurry Recirculation Pumps, Oxidation Blowers, Wet Limestone Grinding Mills, Slurry Pumps, & Agitators which have been designed (either by self manufacturer or under valid ongoing collaboration and technology transfer agreement), *manufactured/ *got manufactured and supplied by us /Manufacturer (or manufactured/ got manufactured & supplied by our proposed sub-vendors) and these are in successful operation in at least one (1) plant for a period not less than one year

E. **Slurry Pumps:** We declare that, we/our Sub-Vendor, have designed (either by itself or under collaboration / licensing agreement), *manufactured/*got manufactured and supplied at least one (1) number of Slurry Pump of minimum 80% of the flow & 100% of the head of the offered Slurry Pump(s), Centrifugal type working in Wet Limestone based FGD application or ash slurry application in coal fired power plant and which has been in successful operation for minimum one (1) year reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder, as per the details furnished below:

Sl. No.	Description	Reference Work
1.	Name of the reference plant & location:	
2.	Client name and his address:	
3.	No. of units and capacity in MW of unit:	
4.	Whether operating in a Wet Limestone based FGD application or similar process/duty application	-*Yes/*No
5.	Whether operating in a similar process/duty application	-*Yes/*No(indicate industry type)
6.	Name of equipment manufacturer & address:	
7.	Date of commission of the equipments:	
8.	Model no. of the equipment:	
9.	Brief Technical particulars of the equipments:	
10.	Flow-	

ATTACHEMENT 3K
Page 12 of 98

Sl. No.	Description	Reference Work
11.	Head-	 meters of liquid column
12.	Whether the equipment(s) are in successful operation in atleast one(01) plant for a period not less than one(01) year reckoned as on the date of consideration for approval but not later than six months to award date of contract to the Main bidder	-*Yes/*No
13.	Flue gas Desulphurization system details:	*Technical extract/ *paper letter/ *email/ *Drawing from user or *contract document or *scheme or *any document in public domain enclosed at annexure....to Attachment-3K
14.	Scope of Work:	*Letter of Award or *Contract or *P.O. enclosed at Annexure.....to Attachment-3K
15.	Performance details:	*Certificate/*Letter/*E-mail from End user enclosed at Annexure.....to Attachment-3K

LOT-1A PROJECTS
 FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE

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



	BHARAT HEAVY ELECTRICALS LIMITED (A GOVT OF INDIA UNDERTAKING)	Water Systems Group- WEG & WS Boiler Auxiliary Plant (BAP), Ranipet
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TECHNICAL SPECIFICATION FOR SLURRY PUMPS

SPECIFICATION NUMBER : ROS:9068
BUYER (EPC) : BHEL, BAP Ranipet
APPLICATION : FLUE GAS DESULPHURIZATION SYSTEM

			<i>A. Kumar</i>	<i>Harshdeep</i>	<i>Im. Ramalingam</i>
00	04-Jul-2020	First Issue	Abhinav Kumar	Harshdeep	IMRL Rao
REV	Date	Description	Prepared	Checked	Approved

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TECHNICAL SPECIFICATION OF SLURRY PUMPS

ROS:9068

CONTENTS

1.0	INTENT OF SPECIFICATION
2.0	APPLICABLE CODES & REGULATIONS
3.0	PROVENNESS CRITERIA
4.0	MATERIAL OF CONSTRUCTION
5.0	SCOPE OF SUPPLY
6.0	DESIGN & CONSTRUCTION
7.0	GENERAL REQUIREMENTS
8.0	PACKING & FORWARDING
9.0	SUPERVISION OF ERECTION, TESTING & COMMISSIONING
10.0	EXCLUSION
11.0	INSPECTION AND TESTING
12.0	PAINTING
13.0	SPARES, TOOLS & TACKLES
14.0	PERFORMANCE GUARANTEE
15.0	BID EVALUATION CRITERIA FOR POWER CONSUMPTION
16.0	LIQUIDATED DAMAGES FOR POWER CONSUMPTION
17.0	WARRANTY
18.0	FIRST FILL OF CONSUMABLES
19.0	TRAINING
20.0	CONFLICT
21.0	DOCUMENTATION
22.0	LIST OF TESTS
	ANNEXURES-I,II,III ANNEXURES-A to H



TECHNICAL SPECIFICATION OF SLURRY PUMPS

ROS:9068

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. For project specific technical parameters, refer to **Annexure-A**. The following points may be noted:

- a. Bidder shall assume full responsibility for the entire equipment assembly and shall comply to the requirements of this specification and referred specifications/attachments to enquiry/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. Any deviation, not listed in Annexure - II, though reflected in any other part of the offer, shall not be considered.
- d. BHEL discretion is final in acceptance / rejection of exceptions / deviations listed by Bidders' proposal in Annexure – II. Only written approval by BHEL is valid means of acceptance of deviation / exception.
- e. 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.
- f. 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.
- g. 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. 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

3.0 PROVENNESS CRITERIA:

Bidders shall meet the Qualification Requirement (QR) for Slurry Pumps as per **Annexure-B** and **submit the Annexure to qualification requirement (Attachment-3K)**. Necessary documentary evidences shall be submitted along with the bid. **Offers of Bidders not meeting Qualification Criteria shall not be considered for evaluation.**



TECHNICAL SPECIFICATION OF SLURRY PUMPS

ROS:9068

4.0 MATERIAL OF CONSTRUCTION

	Material of construction	Horizontal Centrifugal Pumps	Vertical Sump Pumps
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. In case of Hi chrome casing pump the Guaranteed wear life of casing shall not be less than 24000 hrs.	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. In case of Hi chrome casing pump the Guaranteed wear life of casing shall not be less than 24000 hrs.
ii.	Impeller	Hi Chrome or superior material with 14000 hrs guarantee.	Hi Chrome or superior material with 14000 hrs guarantee.
iii.	Solid Shaft	Duplex SS 2205 /EN8D /EN9	Duplex SS 2205
iv.	Shaft sleeve at mechanical seal	CD4MCU ASTM A 743/ Duplex 2205	CD4MCU ASTM A 743/ Duplex 2205
v.	Base Plate	Carbon steel with Epoxy Coating	Carbon steel with Epoxy Coating

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 or Pulley & V-belt (As applicable)
	v. Common base frame for pump & motor and shock pads
	vi. Single Mechanical seal c
	vii. Flushing and drain system Provision to be provided in mechanical seal
	viii. Coupling guards with bolts or V-belt guard (As applicable)
	ix. Discharge pressure guage(to be supplied as loose)
	x. Temporary Strainers required for commissioning
	xi. Expansion joints (Bellows) at suction and Discharge
	xii. Casing drain terminated at battery limit with flange(if applicable)



TECHNICAL SPECIFICATION OF SLURRY PUMPS

ROS:9068

Sl. No	Scope
	xiii. Cooling water piping for Bearing cooling(as applicable)
	xiv. Lubrication system (as applicable)
	xv. Foundation bolts for supplied items
	xvi. Pedestal for Pump
	xvii. Drip tray for drainage collection from pump
	xviii. Lantern Ring (if applicable)
	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 (Internal) Piping within the skid(if applicable)
	xxiv. First fill of consumables like lubricants, etc.,
	xxv. Start-up & Commissioning & Mandatory spares
	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. The composition of Limestone slurry is provided in the Annexure for reference. Bidder shall consider the Slurry pumps accordingly with reference to construction and speed as follows. Tip speed of impeller :(a) for rubber lined pumps should not exceed 25m/sec, (b) for other pumps should not exceed 30m/sec- vendor to furnish. However, if the discharge head exceeds 6.5 bar bidder may consider higher tip speed subject to BHEL approval. The slurry velocity shall be in the range of 1.2 m/s to 2.3 m/s to prevent bed of solids in the pipe. Notwithstanding the above parameters, it shall be the bidders endeavor and responsibility to ensure that there shall be no settling of solids in the pipelines. Necessary calculations shall be submitted to BHEL for review.
3.	Pump in series are not acceptable.
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 a hi-chrome alloy line pump if the bidder has previous experience of the same for similar applications.
5.	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/TIMKEN/ or equivalent subjected to BHEL approval)
6.	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



TECHNICAL SPECIFICATION OF SLURRY PUMPS

ROS:9068

	point unless otherwise mentioned elsewhere. The maximum efficiency of pump shall be at BEP. The maximum efficiency of pump shall preferably be within ± 10% of the rated design flow as indicated in data sheets.		
7.	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.		
8.	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.		
9.	Pumps shall run smoothly without undue noise and vibration. Peak to peak vibration limits shall be restricted to the following values during operation. Pump RPM shall be designed with respect to allowable pump tip speed and selected material of construction for pump impeller in Clause 6.1(2) above.		
	Speed	Antifriction Bearing	Sleeve Bearing
	1500 rpm and below	75.0 micron	75.0 micron
	3000 rpm	50.0 micron	65.0 micron
10.	The pumps shall be capable of starting with discharge valve fully open and close condition. Motors shall be selected to suit to the above requirements. Continuous Motor rating (at 50 deg.C ambient) shall be at least ten percent (10%) above the maximum load demand of the pump in the entire operating range to take care of the system frequency variation and no case less than the maximum power Requirement at any condition of the entire characteristic curve of the pump.		
11.	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).		
12.	Pumps shall be so designed that pump impellers and other accessories of the pumps are not damaged due to flow reversal.		
13.	The Contractor under this specification shall assume full responsibility in the operation of pump and motor as a unit.		
14.	The pumps shall be designed as impeller centrifugal pump. The pumps shall be wear-resistant, be equipped with flushing devices/provision to prevent sedimentation and shall be designed and installed in a manner to allow easy replacements, repair and maintenance.		
15.	Impellers shall be single piece casting. Fabricated impellers shall not be accepted.		
16.	The slurry pumps shall be equipped with oil level indication (if applicable), coupling guard/V-belt guard & equipment for collecting leakage, made of corrosion resistant material.		
17.	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.		
18.	All pumps shall be fitted with pressure gauges on discharge end. (To be supplied loose)		
19.	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. (If Applicable)		
20.	Pumps shall have stable head-capacity characteristics curve from run-off to shut-off.		



TECHNICAL SPECIFICATION OF SLURRY PUMPS

ROS:9068

21.	Selection of Duty point should preferably be at BEP (Best Efficiency Point). 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 at normal water level, pump will operate at the right of BEP. Pump's operating zone shall be considered accordingly.
22.	External flushing is required to remove the accumulated particles and all related information shall be mentioned in data sheet.
23.	Pump should have adjustment provision of axial clearance between casing and impeller for maintenance of performance at best efficiency in the event of wear between impeller and casing.
24.	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. Bidder can also quote pumps with V-belt & Pulley arrangement.
25.	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.
26.	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.
27.	The sealing areas shall be designed in such a way so that solids do not precipitate, affect the cooling, or affect adjustment and mechanical functioning of the seals. Seals requiring jet cleaning shall be avoided. Bidder to furnish the water requirement for Plan 32 & 62 so that BHEL can arrange the same suitably.
28.	Pump induced vibration due to flow pulsations shall be avoided through suitable design.
29.	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 (if twin casing pump), 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. (Pressure Gauge shall be supplied loose) It shall be structurally sound to provide housing for the pump assembly and shall be designed hydraulically to minimum radial load at part load operation.
e.	For single casing pumps, bidder to confirm that in case casing wears out by 50% during operation, pump allowable maximum pressure will not reduce. This shall be confirmed strictly for equipment and plant safety. A basis of calculation proving the same shall be submitted for review.



TECHNICAL SPECIFICATION OF SLURRY PUMPS

ROS:9068

f.	Lifting provision of pump as a whole and individual casing half should be provided.
g.	Renewable wear rings shall be provided at points of running clearance and shall be made from appropriate materials indicated in the referred standards.
B)	IMPELLER
a.	Impeller shall be 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. Bidder may also propose threaded connection between impeller and shaft. Bidder shall provide evidence of zero contact between the slurry being processed and the Threaded region.
b.	Tipspeed of impeller: Please refer Clause 6.1(2)
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 Gr 6.3
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. Maximum size impeller to be quoted or as appropriate technically by the bidder. In case there is variation required in the system then same can be done thru by changing the pump RPM with change in pulley ratio.
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.	No parts of the shaft should come in contact with the liquid medium for horizontal centrifugal pump.



TECHNICAL SPECIFICATION OF SLURRY PUMPS

ROS:9068

i.	Shaft should have a keyed joint at impeller hub or thread connection between impeller and shaft is acceptable however in no circumstances Slurry will come in contact with the threaded part.
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. 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.	Bearing housings on horizontal shaft pumps shall be designed to enable the bearings to be replaced without removing the pump or motor from its mounting. Bearing housings on horizontal shaft pumps shall be effectively protected against the ingress of water, pumped fluid and dust by suitable nonferrous deflectors.
d.	If bearing housing requires cooling water, volume and pressure of cooling water is to be indicated in Technical Data Sheet.
e.	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 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.



TECHNICAL SPECIFICATION OF SLURRY PUMPS

ROS:9068

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.	Seal life shall be guaranteed for 20000 hrs. In the event seals fail before guarantee period, the bidder shall replace the same without any cost implication. Make of Mechanical Seals: Eagle Burgmann/ Flowserve/ John crane only. No other make is acceptable.
H)	COUPLING (if applicable)
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.	Suitable holes shall be provided for grouting and these shall be so located that the base plate can be grouted in place without disturbing the pump and motor.
c.	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.
d.	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.
e.	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
f.	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



TECHNICAL SPECIFICATION OF SLURRY PUMPS

ROS:9068

	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.
	The sump depth is around 4 m. The detailed drawing of the sump will be provided during post ordering stage to the successful bidder. Bidder shall take care of the inlet level of the sump and accordingly take care of the design requirement during detailed engineering.
M)	ACCESSORIES:
1.	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 with respect to strainer size & its mounting holes.

6.3 Motor

Please refer to the motor specification attached TECI: LT MOTOR: REV 03(**Annexure-F**). The motor make is subject to end customer approval. The motor painting schedule is subject to customer approval.

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 dBA 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 /HIS 9.6.4.11 for casing vibrations.
7.	Suitable drain connections shall be provided (as applicable).
8.	The equipment shall be suitable for stable operation continuously.



TECHNICAL SPECIFICATION OF SLURRY PUMPS

ROS:9068

S. No.	Description
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.	Corrosion allowance: Corrosion allowance for entire equipment shall be in accordance with latest applicable Indian / International standard.
11.	Unless otherwise specified , flanges shall be in accordance with ANSI B16.5 Class 150
12.	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.
13.	Rotation arrows shall be cast in or attached with stainless steel plate on each item of rotation equipment at a readily visible location.
14.	Unless otherwise specified, all equipment items where the weight exceeds 15 kg shall be provided with suitable lifting lugs, ears or ring bolts or tapped holes for lifting rings. Minimum shock factor for lifting lugs shall be minimum 2.0. The position of lifting lugs and reference dimension shall be shown on GA and/or outline drawings. NDT shall be conducted for lifting lugs. When any spreader bars are required for lifting and laydown, the bidder shall provide spreader bar with equipment.
15.	Skid Mount/Transportation: Equipment shall be fabricated as skid mount design as much as practical to minimize erection at the site.
16.	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.
17.	Provide double nuts for anchor bolts
18.	Bidder shall provide allowable vibration level on foundation in foundation drawings and/or general arrangement drawings.
19.	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.
20.	Bidder shall provide the mating flanges with the necessary gaskets.
21.	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.
22.	Bidder to provide capacity of crane or hoist required for material handling and the details of heaviest component to be handled.
23.	The list of all Bought out items with makes and country of origin to be mentioned along with offer to be submitted.
24.	Quality Plan to be submitted along with the offer.
25.	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.



TECHNICAL SPECIFICATION OF SLURRY PUMPS

ROS:9068

S. No.	Description
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. PE-TS-888-100-A001 (Annexure-H). Liberal packing materials and struts shall be provided to arrest rolling and to protect from transit damages.
2.	Equipment and process materials shall be packed and semi-knocked down, to the extent possible, to facilitate handling and storage and to protect bearings and other machine surfaces from oxidation. Each container, box, crate or bundle shall be reinforced with steel strapping in such a manner that breaking of one strap will not cause complete failure of packaging. The packing shall be of best standard to withstand rough handling and to provide suitable protection from tropical weather while in transit and while awaiting erection at the site.
3.	Equipment and materials in wooden cases or crates shall be properly cushioned to withstand the abuse of handling, transportation and storage. Packing shall include preservatives suitable to tropical conditions. All machine surfaces and bearings shall be coated with oxidation preventive compounds. All parts subject to damage when in contact with water shall be coated with suitable grease and wrapped in heavy asphalt or tar impregnated paper.
4.	Crates and packing material used for shipping will become the property of owner (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: - Destination - Package Number - Gross and Net Weight - Dimensions - Lifting places - 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



TECHNICAL SPECIFICATION OF SLURRY PUMPS

ROS:9068

S. No.	Description
	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)
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.



TECHNICAL SPECIFICATION OF SLURRY PUMPS

ROS:9068

S. No.	Description
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 visits 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.	Total number of visits shall be 6 and number of days per visit shall be 5 working days. Total number of working days= 6 x 5 = 30 days. Travel duration shall be additional.
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.
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	EXCLUSIONS
	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: The typical quality plan is enclosed with this specification(ANNEXURE-G).
1.	Bidder shall submit the quality plan during the Post ordering stage subject to BHEL / end customer approval.
2.	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.
3.	Test certificates shall be issued for each lot of raw material used in the coating, corresponding to specific weight and traction resistance.
4.	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.
5.	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.



TECHNICAL SPECIFICATION OF SLURRY PUMPS

ROS:9068

S. No.	Description
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 Annexure-E
13.0	SPARES,TOOLS & TACKLES
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.
13.2	MANDATORY SPARES
	The mandatory spares list is provided in the enclosed Annexure-D . The Mandatory spares price will be considered for bid evaluation. Mandatory spare parts items shall be handed over separately and shall not be mixed with the supply of the main equipment parts. Spares shall be sent in pre-decided lots in containers/secure boxes. All boxes/containers are to be distinctly marked in red color with boldly written "S" mark on each face of the containers. Spares shall not be dispatched before dispatch of corresponding main equipment's. Each item shall be labelled in English and be packed against damage and sealed to prevent deterioration from corrosion.



TECHNICAL SPECIFICATION OF SLURRY PUMPS

ROS:9068

S. No.	Description
	All spares supplied under this contract shall be strictly inter-changeable with the parts for which they are intended for replacements. All the Initial spares shall be manufactures along with the main equipment components as a continuous operation as per same specification and quality plan.
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) Noise level ≤ 85 dB (A) at 1m horizontal distance from equipment/enclosures and 1.5m above operating floor is to be guaranteed. 4) 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. 5) Acceptance tests to be carried out as per the procedure defined by the bidder which shall be submitted for BHEL/ CUSTOMER approval. 6) 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. Adjustment factor for excess power consumption in INR = $(GPC-BV) \times PL \times \text{No's of Working pumps}$ GPC- Guaranteed Power Consumption quoted by bidder in KW BV- base Value i.e. lowest quoted power consumption in KW PL- Power Loading Note : For Power Loading Value, refer enclosed Annexure-C.



TECHNICAL SPECIFICATION OF SLURRY PUMPS

ROS:9068

S. No.	Description
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 Note: For Penalty Charges, refer Annexure C. Note: 1. LD will be levied after conducting performance test as above subjected to the maximum 25% 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.
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.



TECHNICAL SPECIFICATION OF SLURRY PUMPS

ROS:9068

S. No.	Description
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). 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.

I. DOCUMENTS TO BE SUBMITTED ALONG WITH THE OFFER:



TECHNICAL SPECIFICATION OF SLURRY PUMPS

ROS:9068

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.	Seal & Sign of bidder on all pages of specification	I	Technical Evaluation of Bid(TEB)
4.	Deviation List (if any)	I	TEB
5.	Slurry Pump & Motor Sizing Calculation	I	TEB
6.	GA drawing all offered pumps with foundation details	I	TEB
7.	Filled Data Sheets of Slurry Pumps & All accessories	I	TEB
8.	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
9.	Required Electric power & other Utility List	I	TEB
10.	Make of all bought out items & sub vendor list	I	TEB
11.	Quality Plan	I	TEB
12.	List of Start-up & Commissioning Spares	I	TEB
13.	List of Special Tools	I	TEB
14.	Delivery Schedule	I	TEB
15.	Catalogue	I	TEB

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



TECHNICAL SPECIFICATION OF SLURRY PUMPS

ROS:9068

Sl. No.	Description	Handing over of Documents after Contract (in weeks)	Purpose
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

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.



TECHNICAL SPECIFICATION OF SLURRY PUMPS

ROS:9068

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.

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 Commissioning	Qty
						m ³ /hr.	meter	rpm		

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

Enquiry No : _____; Project : _____

Sl No	Clause No	Page No	Description of Deviation



TECHNICAL SPECIFICATION OF SLURRY PUMPS

ROS:9068

ANNEXURE-III: SCHEDULE OF GUARANTEES

SL NO	DESCRIPTION	Limestone slurry feed pump	Gypsum bleed pump	Primary hydro cyclone feed tank pump	Filtrate water tank pump	Secondary hydro cyclone feed tank pump	Waste water tank pump	Auxiliary absorbent tank pump	Emergency transfer pump	Absorber area drain sump pump	Gypsum area drain sump pump	Limestone area drain sump pump
1	Rated Capacity of the Pump. (m ³ /hr)											
2	Total Head at design capacity. (m)											
3	Guaranteed power consumption at Motor input Terminal at rated Head & capacity. (kw)											



TECHNICAL SPECIFICATION OF SLURRY PUMPS

ROS:9068

4	Noise level at a distance of 1.0 meter from the equipment at site and 1.5m above operating floor. dB(A)											
5	Maximum vibration (peak to peak amplitude at site). (Microns)											
6	Equipment Availability. (%)											
7	Pump Efficiency (%)											
8	Life of the Pump wear parts including Casing liners bearing etc. (Hours)											

Signature of the Bidder.....

Name.....

POWER LOADING & LIQUIDATED DAMAGES FOR NABINAGAR (3 X 660 MW)

ANNEXURE: G609:C

SL NO	DESCRIPTION	POWER LOADING (PL) for Clause 15 of ROS:9068	LIQUIDATED DAMAGES (LD) (P) for Clause 16.0 of ROS:9068
	PROJECTS		
1	NABINAGR (3 X 660MW)	US \$ 1538/- (US Dollar One Thousand Five Hundred Thirty Eight only) for every KW differential in the power consumption from the lowest value.	US \$ 2484/- (US Dollar Two Thousand Four Hundred Eighty Four only) for every KW increase in Auxiliary power consumption from the Guaranteed value.

Note:.. Acceptable shortfall Limit with LD (+1%) of the guaranteed auxiliary power consumption.

PRODUCT STANDARD
ELECTRICAL, CONTROLS & INSTRUMENTATION
BAP / BHEL / RANIPET – 632 406

TECI: LT MOTOR: REV 03
PAGE 1 OF 8
EFFECTIVE DATE : 10.06.2020

DOCUMENT TITLE : TECHNICAL SPECIFICATION FOR BOUGHT OUT ITEMS
ITEM : LT MOTOR
PROJECT : BHEL STANDARD

	NAME	DESIGNATION	SIGNATURE	DATE
PREPARED BY	ALAN S G	ET		
REVIEWED BY	NAZEER AHAMED T M	DGM		
APPROVED BY	JEYAMURUGANAND M	AGM		

ISSUED BY EDC – ECI

RECORD OF REVISIONS:

REVISION NUMBER 00	INITIAL RELEASE - Dt. 19.03.2013
REVISION NUMBER 01	
REVISION NUMBER 02	Cl. No: 5- Packing and Drawing included
REVISION NUMBER 03	Cl.No :2.1 Latest Standards updated, Cl. No: 2.20, 2.38, 2.39 added

PRODUCT STANDARD
ELECTRICAL, CONTROLS & INSTRUMENTATION
BAP / BHEL / RANIPET – 632 406

TECI: LT MOTOR: REV 03
PAGE 2 OF 8
EFFECTIVE DATE : 10.06.2020

**VENDOR
COMPLIANCE/
REMARKS**

SPECIFICATION

1 SITE CONDITIONS

1.1	Altitude above mean sea level	>1000 m.	
1.2	Ambient temperature condition	6 to 50°C.	
1.3	Relative humidity	100%	
1.4	Atmosphere	Tropical ,Dusty, salty, corrosive & highly polluted as in a coal based Thermal power plant.	

2 GENERAL

2.1	Reference standards	IS 15999, IS 12615, IS/IEC-60034,IS 1231, IS 6362, IS 2253, IS 12065, IS 12075	
2.2	Design ambient	50 Deg.C	
2.3	Application/ Type(Normal/ Energy efficient)	As per Enquiry & PO.	
2.4	Duty cycle	Continuous S1	
2.5	Rated voltage, frequency & Phases	415 V AC $\pm 10\%$; 50 Hz (+5% to -5%); 3 phase	
2.6	Combined variation of Voltage and frequency	10% absolute sum	
2.7	Motors efficiency class	As per Enquiry	
2.8	Minimum starting voltage	80% of the rated voltage	
2.9	Minimum voltage under which motor will run satisfactorily	75% of the rated voltage for 5 minutes	
2.10.	Capacity to restart (at specified voltage)	i. Two successive starts from cold condition ii. Two HOT restarts starts from Hot condition iii. Three equally spread start per hour	
2.11	High speed bus transfer withstand capability	Suitable to withstand 150 % of rated voltage	
2.12	Type of balancing for rotor	Dynamic balancing	
2.13	Direction of rotation	Suitable for both direction	
2.14	Direction of cooling air	Non-drive end to driving end	
2.15	Class of insulation	Class F with temperature rise limited to Class B.	
2.16	Winding treatment	The insulation shall be given tropical and fungicidal treatment for successful operation of the motor in hot , humid & tropical climate.	
2.17	Allowed winding temperature rise at continuous full load	60°C by thermometer method & 70°C by resistance method	
2.18	Accelerating Torque at minimum permissible Starting voltage	10% of full Load Torque	

PRODUCT STANDARD
ELECTRICAL, CONTROLS & INSTRUMENTATION
BAP / BHEL / RANIPET – 632 406

TECI: LT MOTOR: REV 03
PAGE 3 OF 8
EFFECTIVE DATE : 10.06.2020

2.19	Pullout Torque at rated voltage	205% of full load torque	
2.20.	Ratio of Locked rotor KVA to KW for	As per annexure 'A'	
2.21	Starting current	Less than or equal to 700% full load current subject to tolerance as per IS- Energy efficient	
2.22	Starting time & locked rotor withstand time	The locked rotor withstand time (LRWT) at 110% rated voltage (RV) under HOT condition shall be at least 2.5 sec more than the starting time at 80% of rated voltage for motors with acceleration time upto 20 sec at RV and 5 sec where the accelerating time is more than 20 sec at RV.	
2.23	Momentary overload withstand capability	60% of full load torque for 15 second without any damage.	
2.24	Over speed withstand	120% of rated speed for 2 minutes without any mechanical damage.	
2.25	Hot thermal withstand curve	margin of at least 10% over the full load current	
2.26	Cooling	Totally enclosed fan cooled- IC 411(TEFC)	
2.27	Vibration	The peak amplitude of vibration shall be as per IS 12075	
2.28	Noise level	Within the limits specified by IS 12065 / <80 dB at 1 meter distance from motor.	
2.29	Type of enclosure	TEFC, IP 55 as per IS/IEC 60034-5	
2.30.	Type of mounting	Horizontal foot mounted.	
2.31	Bearings	Ball or roller type / bearings effectively sealed against ingress of dust. The bearing shall be so constructed that the loss of lubricating grease is kept to minimum. Sealed bearings are also acceptable	
2.32	Lubricant Type	Grease	
2.33	Bearing life	minimum life of 40000 Working hours	
2.34	Shaft extension	Key slotted bare shaft extension with key at the driving end.	
2.35	Terminal box Type	Weather proof IP 55 as per IS/IEC 60034-5; Capable of being turned through 360° in steps of 90°.	
2.36	Cable gland and lugs	Double compression type nickel plated brass cable glands and insulated tinned copper crimping lugs to suit the cable size i) Size of power cables will be intimated after PO. ii) For space heater cable glands and lugs suitable for 2CX2.5 to be provided	

PRODUCT STANDARD
ELECTRICAL, CONTROLS & INSTRUMENTATION
BAP / BHEL / RANIPET – 632 406

TECI: LT MOTOR: REV 03
PAGE 4 OF 8
EFFECTIVE DATE : 10.06.2020

2.37	Type of terminals	Stud / screw type with plain washers, spring washers / checknuts & lugs	
2.38	Min.Spacing between Gland plate and Center stud(in mm)	As per Annexure 'B'	
2.39	Phase to Phase/Phase to Earth air clearance(in mm) in Terminal Box	As per annexure 'C'	
2.40.	Fault level	50KA for 1Sec	
2.41	Painting	As per Enquiry or PO	
2.42	Space heaters:		
2.42.a	i) Motors above 30 kW	Separate space heater suitable for 240V, Single Phase, AC,50 Hz	
2.42.b	ii) Motors below 30 kW	Winding shall be suitable for heating at 24 V, Single phase, AC,50 Hz	
2.43	Terminals for space heater	Refer Annexure E	
2.44	RTD for winding	Two numbers of Thermistors / RTD for each phase as below are to be provided A. Motors above 37 Kw shall have thermistors Or RTD if specifically called for in enquiry. B. Motor rated 160kW and above shall have RTDs	
2.45	Bearing RTD	For motors 132 Kw and above	
2.46	Terminals for RTD/ Thermistor	Thermistors/ RTDs shall be terminated in a auxiliary terminal box. Details shall be furnished in TB diagram.	
2.47	Earthing	Two no of earthing provisions on terminal box and on motor body(on opposite sides)	
2.48	Name plate	As per IS/IEC 60034-8 and Additional data on name plate: a. Bearing DE/ NDE details. b. Year of manufacture	
2.49	Lifting Device	Eye bolt or lugs to facilitate safe lifting	
3	INSPECTION & TESTING	As per applicable quality plan	

PRODUCT STANDARD
ELECTRICAL, CONTROLS & INSTRUMENTATION
BAP / BHEL / RANIPET – 632 406

TECI: LT MOTOR: REV 03
PAGE 5 OF 8
EFFECTIVE DATE : 10.06.2020

4 **DOCUMENTS**

a) Along with offer:	One set of technical data sheet as per the enclosed format and Motor general arrangement drawing giving foundation details, shaft details.	
b) After placement of Purchase order (within 15 days)	Three sets of the following for approval: 1. Technical Data sheet as per the enclosed format of TECI LTMOTOR REV 00- sh 6 to 8 2. Motor general arrangement drawing giving foundation details, shaft details and weight 3. Motor Terminal box arrangement drawing 4. Motor characteristic curves : Torque vs Speed with load curve superimposed Speed vs Current Time vs Current Thermal with stand curve Load vs Efficiency Load vs Slip Load vs Power factor Speed vs Time Load vs Current 5. Steel crate packing drawing. The following shall be submitted: 1. Guarantee certificate. 2. O & M manuals. 3. Acceleration time and LRWT calculation shall be submitted for review.	

5 **PACKING**

	a) As per Drawing No:- 3-00-114-39893 b) The packing shall meet the Transport, Environment & Storage hazards. c) As per Packing Procedure QA:CI: STD:PR:03 or as per Manufacturer's Standard Practice subject to approval.	
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PRODUCT STANDARD
ELECTRICAL, CONTROLS & INSTRUMENTATION
BAP / BHEL / RANIPET – 632 406

TECI: LT MOTOR: REV 03
PAGE 6 OF 8
EFFECTIVE DATE : 10.06.2020

ANNEXURE 'A'(FOR NTPC)

Ratio of Locked rotor KVA to KW	
i) 50KW to 110KW	11
ii) 110KW to 200KW	9

ANNEXURE 'B'(FOR NTPC)

Min.Spacing between Gland plate and Center stud(in mm)	
upto 3KW	As per manufacturer's practice
above 3KW and upto 7KW	85
above 7KW and upto 13KW	115
above 13KW and upto 24KW	167
above 24KW and upto 37KW	196
above 37KW and upto 55KW	249
above 55kw and upto 90KW	277
above 90KW and upto 125KW	331
above 125KW and upto 200KW	203

ANNEXURE 'C'(FOR NTPC)

Phase to Phase/Phase to Earth air clearance(in mm) in Terminal Box	
upto 110	10
above 110kw and upto 150KW	12.5
above 150KW	19

ANNEXURE 'D'

ADDITIONAL DATA TO BE INCLUDED IN DATASHEET (FOR NTPC)	
GRADE OF BALANCING OF MOTOR	
STANDARD CONTINUOUS RATING AT 40DEG.C AMBIENT	
DERATED RATING OF MOTOR AT 50DEG.C	
NO LOAD CURRENT OF MOTOR AT RATED VOLTAGE AND FREQUENCY	
STARTING TORQUE VALUE IN KGM	
LOCKED ROTOR KVA @ RATED KW	
POWER FACTOR AND EFFICIENCY AT 75% LOAD	
POWER FACTOR AND EFFICIENCY AT 50% LOAD	

PRODUCT STANDARD
ELECTRICAL, CONTROLS & INSTRUMENTATION
BAP / BHEL / RANIPET – 632 406

TECI: LT MOTOR: REV 03
PAGE 7 OF 8
EFFECTIVE DATE : 10.06.2020

ANNEXURE 'E'

SPACE HEATER TERMINAL	
FOR NTPC	Separate terminal box shall be provided
FOR NON-NTPC	Separately terminated in the main terminal box

ANNEXURE : G609 : E**Painting Specification for Slurry Pump:**

Surface Preparation : Power Tool Cleaning to St3 (SSPC-SP3)				
Coating Procedure :				
Sl No.	Coat	Paint	No. of Coats / DFT	Total DFT μm (min)
1.	Primer coat	Red Oxide Zinc Phosphate Primer to IS: 12744 (Two coats)	2 Coat/DFT= 60μm per coat	210 Microns
2.	Intermediate Coat	One coat of Synthetic Enamel intermediate coat to IS 2932;	1 Coat/DFT= 50μm per coat	
3.	Finish coat	Two coats of Synthetic Enamel to IS 2932, DFT- 50μ/ coat	2 Coat/DFT= 100μm per coat	
Shade : Light Blue RAL 5012				

GENERAL NOTES

- 1). No painting is required for Galvanized, non-ferrous & stainless steel items, except as indicated above.
- 2). Machined items are to be applied with coat of temporary rust preventive oil.
- 3). All steel structures shall be provided with painting as given in the specification.
- 4). Finish coat to be applied after an interval of min 10 hrs. And within 6 months (after completion of intermediate coat).
- 5). Primer coat on steel shall be applied in shop immediately after blast cleaning by airless spray technique.

TYPICAL QUALITY PLAN

		MANUFACTURING QUALITY PLAN						PROJECT: 2X490MW NTPC DADRI PACKAGE: FGD PACKAGE CONTRACT No.: CS-6130-109-9-FC-NOA-6641 CUST No: G501-G502 Contractor- BHEL						
		Manufacturer Name and Address M/s Xiangyang Wuerwu, Hubei, China			ITEM: Slurry Pump									
					QP NO: FGD 701, REV: 03 DT: 30.10.2018									
					Page 1 of 4									
SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUATUM 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	NTPC 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	NTPC 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	



Signature Not Verified

	Prepared by	LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (✓) UNDER COLUMN 'D' SHALL BE SUBMITTED TO CUSTOMER AS A QA DOCUMENTATION PACKAGE. M: MANUFACTURE/SUB SUPPLIER, C MAIN CONTRACTOR/ N: NTPC, P: PERFORM W: WITNESS AND V: REVIEW OF RECORDS MTC: Material test certificate, COC: Certificate of Compliance, IR : Inspection report.	Signature Not Verified Digitally signed by Rakesh Sharma Date: 2018.12.24 10:50:48 IST Reason: CAT I Location: NTPCEOC		
	Approved by				
	SIGNATURE				
		FOR CUSTOMER USE	REVIEWED BY	APPROVED BY	APPROVAL SEAL

		MANUFACTURING QUALITY PLAN							PROJECT: 2X490MW NTPC DADRI PACKAGE: FGD PACKAGE CONTRACT No.: CS-6130-109-9-FC-NOA-6641 CUST No: G501-G502 Contractor- BHEL						
		Manufacturer Name and Address M/s Xiangyang Wuerwu, Hubei,China			ITEM: Slurry Pump				FORMAT OF RECORD		AGENCY			REMARKS	
					QP NO:FGD.701,REV.03 DT: 30.10.2018										
					Page 2 of 4										
SL. NO.	COMPONENT & OPERATION	CHARATERISTICS	CLASS	TYPE OF CHECK	QUATUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANC E NORMS							
					M	C/N					M	C	N		
1	2	3	4	5	6		7	8	9	D*	10			11	
	Shafts after machining	Surface Defect	Major	DPT Static & dynamic	100%		ASTM E 165	ASME Sec V	Insp Report	√	P	V	V		
2.2	Impeller & shaft	Residual Unbalance	Major	Balancing	100%		Relevant Standard/ISO 1940 Gr 6.3	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 Head Or 150% Of Shut Off Head, Whichever Is Higher, for at least 30min.	
2.4	Motor See Note-1& 2	Make, Type, Rating	Major	Visual	100%		NTPC Approved Drawing / Data Sheet		Routine Test Report/CO C	√	P	V	V	Motor Up to 30kw COC Will Be Provided.	
3.0 FINAL INSPECTION															
3.1	Complete Pump	Dimensions	Major	Measurement And Visual	100%		Manufacturer Drawing		Inspection Report	√	P	W	W		
3.2	Performance Test	Flow, Head, Efficiency, BHP at Rated Speed	Major	Measurement And Visual	100%	I/ model	NTPC Approved Drawing / Data Sheet		Inspection Report	√	P	W*	W*	*NTPC witness one No. for	
MANUFACTURER		Prepared by		LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (√) UNDER COLUMN 'D'SHALL BE SUBMITTED TO CUSTOMER AS A QA DOCUMENTATION PACKAGE. M: MANUFACTURE/SUB SUPPLIER, C MAIN CONTRACTOR/ N:NTPC, P: PERFORM W: WITNESS AND V: REVIEW OF RECORDS MTC: Material test certificate. COC: Certificate of Compliance. IR : Inspection report.				DOC.NO REV 00 CAT.....							
APPROVED BY		Approved by						FOR CUSTOMER USE							
SIGNATURE										REVIEWED BY		APPROVED BY		APPROVAL SEAL	

		MANUFACTURING QUALITY PLAN						PROJECT: 2X490MW NTPC DADRI PACKAGE: FGD PACKAGE CONTRACT No.: CS-6130-109-9-FC-NOA-6641 CUST No: G501-G502 Contractor- BHEL						
		Manufacturer Name and Address M/s Xiangyang Wuerwu, Hubei, China			ITEM: Slurry Pump									
					QP NO:FGD.701,REV:03 DT: 30.10.2018									
					Page 3 of 4									
SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUATUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	M	C/N	7	8	9	D*	10			11

		2)Vibration and Noise Level 3)Leakage Test												higher rated capacity pump only. ** BHEL witness 100% for higher rated capacity pump. For rest of the pumps- one pump/model
		Strip Down Test Not Required If Performance Test Is Fine	Major	Visual	100 %	1/ model	Mfg. Drawing, Approved Data Sheet		√	P	W	W		Only Required in Case of Abnormal. Sound

	MANUFACTURER	Prepared by	LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (√) UNDER COLUMN "D" SHALL BE SUBMITTED TO CUSTOMER AS A QA DOCUMENTATION PACKAGE. M: MANUFACTURE/SUB SUPPLIER, C MAIN CONTRACTOR/ N: NTPC, P: PERFORM W: WITNESS AND V: REVIEW OF RECORDS MTC: Material test certificate. COC: Certificate of Compliance. IR : Inspection report.	DOC.NO REV 00 CAT.....		
		Approved by				
	SIGNATURE			FOR CUSTOMER USE	REVIEWED BY	APPROVED BY

		MANUFACTURING QUALITY PLAN						PROJECT: 2X490MW NTPC DADRI PACKAGE: FGD PACKAGE CONTRACT No.: CS-6130-109-9-FC-NOA-6641 CUST No: G501-G502 Contractor- BHEL						
		Manufacturer Name and Address M/s Xiangyang Wuerwu, Hubei, China			ITEM: Slurry Pump									
					QP NO-FGD-701.REV.03 DT: 30.10.2018									
					Page 4 of 4									
SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUATUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	M	C/N	7	8	9	D*	M	C	N	11
3.3	Painting Check	DFT, Paint Shade	Major	Measurement And Visual	100 %	Ra ndo m	NTPC Approved Painting scheme	Inspection Report	√	P	W	V	Quality Dossier To Be Submitted Finally.	

NOTES: 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).

	Prepared by	LEGEND: * RECORDS, IDENTIFIED WITH "TICK" (√) UNDER COLUMN 'D' SHALL BE SUBMITTED TO CUSTOMER AS A QA DOCUMENTATION PACKAGE. M: MANUFACTURE/SUB SUPPLIER, C MAIN CONTRACTOR/ N: NTPC, P: PERFORM W: WITNESS AND V: REVIEW OF RECORDS MTC: Material test certificate, COC: Certificate of Compliance, IR : Inspection report.	DOC.NO REV 00 CAT.....		
	Approved by		FOR CUSTOMER USE	REVIEWED BY	APPROVED BY
SIGNATURE					

OEM SUPPLIER WITH OEM MFR.'s LOGO (TO BE FILLED BY OEM SUPPLIER)	LT MOTOR MANUFACTURER'S NAME AND ADDRESS (TO BE FILLED BY OEM / LT MOTOR MANUFACTURE)	MANUFACTURING QUALITY PLAN				PROJECT: NTPC Nabinagar 4 x 250 MW (BHEL W.O no: G 201, G 202, G 203 and G204) NTPC Nabinagar 3 x 660 MW (BHEL W.O no: G 609, G 610 and G 611) FGD PACKAGE NTPC CONTRACT NO: CS-0270-109(1A) -2-FC/19-20/1819 for Nabinagar 4 x 250 MW CS-0370-109-(1A) -2-FC -NOA-0059 1819 for Nabinagar 3 x 660 MW MAIN CONTRACTOR: BHEL - RANIPET SUB CONTRACTOR (OEM) & ADDRESS: (TO BE FILLED BY OEM SUPPLIER)			
		ITEM: LT MOTOR(IE3) UP TO 200KW FOR FGD APPLICATION SUB-SYSTEM: FGD - SLURRY PUMPS	QP NO.: SLURRY PUMPS :LT MOTOR:001 REV.NO.: 00 DATE: PAGE: OF....						

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.

		LEGEND: * RECORDS, IDENTIFIED WITH “TICK” (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. ** M: OEM MANUFACTURER/LT MOTOR SUB-SUPPLIER C: MAIN SUPPLIER – BHEL/BHEL AIA , N: NTPC P: PERFORM W: WITNESS AND V: VERIFICATION, AS APPROPRIATE, CHP: NTPC SHALL IDENTIFIED IN COLUM “N” AS ‘W”		DOC. NO.:		REV..... CAT.....	
OEM MANUFACTURER/ LT MOTOR SUPPLIER	MAIN (BHEL) SUPPLIER		FOR NTPC USE				
SIGNATURE				REVIEWED BY	APPROVED BY	APPROVAL SEAL	

ENDORSEMENT SHEET FOR QP
REFERENCE / STANDARD / FIELD QUALITY PLAN (RQP / SQP/RFQP/SFQP)

TO BE FILLED IN BY SUPPLIER AT TIME OF SUBMISSION			To be filled in by NTPC
PROJECT NAME	NTPC Nabinagar 4 x 250 MW (BHEL W.O no: G 201, G 202, G 203 and G204) NTPC Nabinagar 3 x 660 MW (BHEL W.O no: G 609, G 610 and G 611)	<u>2REVIEW & ENDORSEMENT BY NTPC</u> PROJECT SPECIFIC QP NUMBER ALLOTTED QP NO: REV. NO.: 00 DT :	
CONTRACT NO.:	CS-0270-109(1A) -2-FC/19-20/1819 for Nabinagar 4 x 250 MW CS-0370-109-(1A) -2-FC -NOA-0059 1819 for Nabinagar 3 x 660 MW		
MAIN SUPPLIER	M/S.BHEL, RANIPET , TAMIL NADU., INDIA		
MANUFACTURER WORKS & ADDRESS	(TO BE FILLED BY OEM / LT MOTOR SUPPLIER)		
ITEM /EQUIPMENT / SYSTEM/ SUB-SYSTEM DETAILS i.e. MODEL TYPE/SIZE/RATING etc.	LT MOTOR(IE3) - SLURRY PUMPS FOR FGD APPLICATION		
APPROVED QP NO.: RQP/SQP/RFQP/SFQP	(TO BE FILLED BY OEM / LT MOTOR SUPPLIER)		
Confirmation by Main Supplier (TICK WHICHEVER APPLICABLE)		(TICK APPLICABLE)	
I. That the item/ component is identical to that considered for SQP approval. ✓		The MQP/RQP/SQP is endorsed for this project without any change The SQP is endorsed for this project with changes as indicated.	
II. That there are minor changes in the item/ component with respect to that considered for MQP/RQP/SQP approval, however the same do not affect the contents of MQP/RQP/SQP			
III. That there are minor changes in the item/ component with respect to that considered for MQP/RQP/SQP approval, however the same affect the MQP/RQP/SQP slightly, as indicated below / in attached sheet.			
		<u>DISTRIBUTION OF ENDORSEMENT OF</u> A) MQP/RQP/SQP: 1. MAIN SUPPLIER (WITH A COPY OF MQP/RQP/SQP) 2. MANUFACTURER 3. RIO 4. CQA-SPL 5. CQA-O/C B) RFQP/SFQP: 1. MAIN SUPPLIER (with a copy of MQP/RQP/SQP) 2. MANUFACTURER 3. NTPC FQA (with a copy of MQP/RQP/SQP) 4. NTPC Erection (with a copy of MQP/RQP/SQP) 5. CQA-SPL 6. CQA-O/C	
SIGN.: (Main Supplier) DATE:	(TO BE FILLED BY OEM / LT MOTOR SUPPLIER)	NTPC (Reviewed /Approved by/ Date & Seal)	
	SIGN.: (Manufacturer) DATE:		

BHEL BAP/ RANIPET / TAMIL NADU INDIA		OEM SUPPLIER To be filled by OEM Supplier		MANUFACTURING QUALITY PLAN FOR LT MOTOR (Up to TO 200KW) - FGD Application					MQP:E:LTM:NABINAGAR :FGD SLURRY :001			
		LT MOTOR Manufacture To be filled by OEM Supplier							REV:NO:00			
		DATE: 17.07.2020										
		Page :										
S1.No.	COMPONENT/ASSEMBLY/OPERATION/TESTS	CHARACTERISTIC	CLASS	TYPE OF CHECK	QUANTITY OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	FORMAT OF REC	D	M	BHEL/BHEL AIA	REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	
INCOMING INSPECTIONS:												
1.1	Enamelled round copper conductor(Dual coated)MM	1.Overall diameter	Major	Mechanical	1 sample/lot	IS 13730 1993 Part 13 / IEC 60317-0-1-2008 (As applicable)	IEC 60317-0-1 2008	Plant format		P	V	
		2.Bare conductor diameter	Major	Mechanical	1 sample/lot	BHEL / NTPC Spec & Apprd Datasheet	BHEL / NTPC Spec & Apprd Datasheet	Plant format		P	V	
		3.BDV test	Major	Electrical	1 sample/lot	--do--	--do--	Plant format		P	V	
		4.Elongation	Major	Mechanical	1 sample/lot	--do--	--do--	Plant format		P	V	
		5.Continuity (insulation)	Major	Electrical	1 sample/lot	--do--	--do--	Insp report/ Supplier TC		P	V	
		6.Tan Delta (If applicable)	Major	Electrical	1 sample/lot	--do--	--do--	Insp report/ Supplier TC		P	V	
1.2	Aluminum Ingots	1.Chemical composition	Major	Chemical	1 sample/lot	--do--	--do--	Supplier Tc		P	V	EC gr purity: -99.6%
1.3	FAN	1.Diameter (ID&OD)	Major	Mechanical	1 sample/lot	--do--	--do--	Inspection Report		P	V	
1.4	Bearings (SKF OR FAG)	1.Type & Make	Major	Visual	100%	--do--	--do--	Inspection Record		P	V	
		2.Dimensions - ID,OD&width	Major	Mechanical	1 sample/lot	--do--	--do--	Inspection Record		P	V	
1.5	Terminal Block	1.Dimensions	Major	Mechanical	Plant std.	--do--	--do--	Inspection Report		P	V	
		2.Proof voltage test	Major	Electrical	Plant std.	--do--	--do--	Inspection Report		P	V	

BHEL BAP/ RANIPET / TAMIL NADU INDIA		OEM SUPPLIER To be filled by OEM Supplier		MANUFACTURING QUALITY PLAN FOR LT MOTOR (Up to TO 200KW) - FGD Application					MQP:E:LTM:NABINAGAR :FGD SLURRY :001			
		LT MOTOR Manufacture							REV:NO:00			
		To be filled by OEM Supplier							DATE: 17.07.2020			
		Page :										
S1.No.	COMPONET/ASSEMBLY/OPERATION/TESTS	CHARACTERISTIC	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	FORMAT OF REC	D	AGENCY		REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	
INPROCESS INSPCETIONS:												
2.1	Stator core	1.Core length dia	Major	Mechanical	100%	--do--	--do--	Inspection Record		P	V	
		2.Core locking	Major	Visual	100%	--do--	--do--	Inspection Record		P	V	
		3.Rigidity of core	Major	Mechanical	100%	--do--	--do--	Inspection Record		P	V	
2.2	Die cast rotor	1.Core length	Major	Mechanical	100%	--do--	--do--	Inspection Record		P	V	
		2.Blow holes	Major	Mechanical	100%	--do--	--do--	Inspection Record		P	V	
2.3	Wound stator (if applicable)	1.Resistance	Major	Electrical	100%	--do--	--do--	Inspection Record		P	V	
		2.H.V.Test	Major	Electrical	100%	--do--	--do--	Inspection Record		P	V	
		3.Insulation resistance	Major	Electrical	100%	--do--	--do--	Inspection Record		P	V	
2.4	Final Assembly	1.Completeness	Major	Visual	100%	--do--	--do--	Inspection Record		P	V	
		2.Runout in case of flanged motors	Major	Mechanical	100%	--do--	--do--	Inspection Record		P	V	
		3.Mounting dimensions	Major	Mechanical	100%	--do--	--do--	Inspection Record		P	V	

BHEL BAP/ RANIPET / TAMIL NADU INDIA		OEM SUPPLIER To be filled by OEM Supplier		MANUFACTURING QUALITY PLAN FOR LT MOTOR (Up to TO 200KW) - FGD Application				MQP:E:LTM:NABINAGAR :FGD SLURRY :001				
		LT MOTOR Manufacture						REV:NO:00				
		To be filled by OEM Supplier						DATE: 17.07.2020				
		Page :										
S1.No.	COMPONENT/ASSEMBLY/OPERATION/TESTS	CHARACTERISTIC	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	FORMAT OF REC	D	AGENCY M	BHEL/ BHEL AIA	REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	
FINAL INSPCETION AND TESTING:												
3.1	Routine Test	1.Resistance Measurement on winding & space heater	Major	Electrical	100%	BHEL / NTPC Spec, GA Drawing & Apprd Datasheet and IS/IEC 60034 (As applicable)	BHEL / NTPC Spec, GA Drawing & Apprd Datasheet and IS/IEC 60034 (As applicable)	Inspection Record		P	W	
		2.HV Test	Major	Electrical	100%	--do--	--do--	Inspection Record		P	W	
		3.Phase sequence & direction of rotation	Major	Electrical	100%	--do--	--do--	Inspection Record		P	W	
		4.No load run test	Major	Electrical	100%	--do--	--do--	Inspection Record		P	W	
		5.Vibration test	Major	Mechanical	100%	--do--	--do--	Inspection Record		P	W	
		6.Name plate recheck	Major	Visual	100%	--do--	--do--	Inspection Record		P	W	
		7.Paint shade thickness & adhesion	Major	Visual & Measurement	100%	--do--	--do--	Inspection Record		P	W	
		8.Moutings & Overall dimensions	Major	Mechanical	100%	--do--	-do-	Inspection Record		P	W	

BHEL BAP/ RANIPET / TAMIL NADU INDIA		OEM SUPPLIER To be filled by OEM Supplier		MANUFACTURING QUALITY PLAN FOR LT MOTOR (Up to TO 200KW) - FGD Application					MQP:E:LTM:NABINAGAR :FGD SLURRY :001 REV:NO:00 DATE: 17.07.2020 Page :			
		LT MOTOR Manufacture										
		To be filled by OEM Supplier										
S1.No.	COMPONET/A SSEMBLY/OP ERATION/TESTS	CHARACTE- RISTIC	CLASS	TYPE OF CHECK	QUANUTM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE STANDARD	FORMAT OF REC	D	AGENCY M	BHEL/ BHEL AIA	REMARKS
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	
3.2 TYPE TESTS ###												
3.3	Preservation and Packing	1.Completeness	Major	Review	100%	--do--	--do--	Inspection Record		P	V	
		2.Motors covered with polythene sheets	Major	Visual	100%	--do--	--do--	Inspection Record		P	V	
		3.Packing	Major	Visual	100%	--do--	--do--	Inspection Record		P	V	
### TYPE TEST REQUIREMENTS FOR LT MOTOR INCLUDING DEGREE OF PROTECTION TEST REPORT (IP 55) BHEL/BHEL AIA (Authorised Inspection Agency) shall review the Identical design type test report during including degree of Protection Test report (IP 55) for acceptance in line with BHEL/ Ultimate Customer - NTPC approved Data sheet/Drg/Spec for LT Motor rating up to 50KW and BHEL/Ultimate Customer NTPC approved type test report for LT Motor rating more than 50KW and up to 200KW. If not available for Similar / Identical Design of any of the LT Motor motor, then OEM / LT Motor Manufacture shall conduct all these type tests at Third party lab / Government Approved Lab / Own lab in presence of BHEL/BHEL AIA / without any cost implication to BHEL/Ultimate Customer - NTPC within reasonable time.												
1. Measurement of Resistance of Stator 2. No Load test at Rated Voltage 3,. Pull out test 4.Temperature Rise Test 5.Momentary Excees Torque Torque Test 6.High Voltage Test 7.Test for Vibration Severity 8.Test for Noise Level Measurement 9. Over Speed Test 10. Degree of Protection TC (IP 55)												
LEGEND: OEM = Orgional Equipement Supplier M = LT Motor Manufacture - BHEL AIA = BHEL AUTHORISED INSPECTION AGENCY GA Drawing : General Arrangment Drawing NTPC - NATIONAL THERMAL POWER CORPORATION (Ultimate Customer) OEM SUPPLIER : (To be Filled up by OEM Supplier) LT MOTOR Manufacture : (To be Filled up by OEM Supplier)												

Annexure-I

CONTRACT QUALITY REQUIREMENTS (CQR) for LT MOTORS(IE3) Up to 200KW

(For INDIGENOUS OEM VENDOR ONLY)

PROJECT: NTPC Nabinagar 4 x 250 MW (BHEL W.O no: G 201, G 202, G 203 and G 204) NTPC Nabinagar 3 x 660 MW (BHEL W.O no: G 609, G 610 and G 611) NTPC CONTRACT NO: CS-0270-109(1A) -2-FC/19-20/1819 for Nabinagar 4 x 250 MW CS-0370-109-(1A) -2-FC -NOA-0059 1819 for Nabinagar 3 x 660 MW PACKAGE: FGD PACKAGE MAIN CONTRACTOR: BHEL - RANIPET SUB CONTRACTOR (OEM) & ADDRESS: (To be filled by OEM VENDOR)		CONTRACT QUALITY REQUIREMENTS (CQR) for <u>LT MOTORS(IE3) - Up to 200KW</u> NTPC Nabinagar 4 x 250 MW (BHEL W.O no: G 201, G 202, G 203 and G 204) NTPC Nabinagar 3 x 660 MW (BHEL W.O no: G 609, G 610 and G 611)	DOC.NO: BAP/QR/G201 to G204, G609 to G611/Nabinagar/ LTM/ Slurry Pumps: 001 Rev NO.: 00 PAGE : Page 1 of 7 DATE: 17.07.2020	##Enquiry No: ## OEM Supplier Name & Address: ##Offer reference: ##Date: Contact Official Name: Mobile no: Email id:
Sl. NO.	DESCRIPTION	BHEL and Ultimate Customer - NTPC (National Thermal Power Corporation),, India Quality Requirements		##Specific confirmations by the vendor

ITEM: LT Motors (IE3) Up to 200KW

01	Type Test Requirements	A. Vendor shall submit the type test reports of all the type tests as listed in SL NO: 01 (D) below and carried out within 10 years from the data of ultimate NTPC bid opening dt 01.08.2018. These reports should be for the test conducted on the identical/similar LT Motors to those proposed to be supplied under this enquiry and test (s) either should have been conducted at an independent laboratory (or) should have been witnessed by BHEL AIA (BHEL Appointed Inspection Agency) / BHEL (or) Ultimate client NTPC at respective LT Motor Manufacture of OEM vendor.	
		B. However, if vendor is not able to submit the similar / identical type test report as per above condition (or) in the case of type test reports are not found to be meeting the specification requirement, the vendor shall conduct all the tests at no additional cost to BHEL either at third party lab (or) own lab in the presence of BHEL AIA (BHEL Appointed Inspection Agency) / BHEL /Ultimate client NTPC and submit the reports for review & approval.	
		C. Type Test reports review and approval by BHEL AIA (BHEL Appointed Inspection Agency) / BHEL / Ultimate client NTPC is must in line with NTPC approved data sheet / BOM/GA Drawing etc.	

Annexure-I

CONTRACT QUALITY REQUIREMENTS (CQR) for LT MOTORS(IE3) Up to 200KW

(For INDIGENOUS OEM VENDOR ONLY)

PROJECT: NTPC Nabinagar 4 x 250 MW (BHEL W.O no: G 201, G 202, G 203 and G 204) NTPC Nabinagar 3 x 660 MW (BHEL W.O no: G 609, G 610 and G 611) NTPC CONTRACT NO: CS-0270-109(1A) -2-FC/19-20/1819 for Nabinagar 4 x 250 MW CS-0370-109-(1A) -2-FC -NOA-0059 1819 for Nabinagar 3 x 660 MW PACKAGE: FGD PACKAGE MAIN CONTRACTOR: BHEL - RANIPET SUB CONTRACTOR (OEM) & ADDRESS: (To be filled by OEM VENDOR)	CONTRACT QUALITY REQUIREMENTS (CQR) for LT MOTORS(IE3) - Up to 200KW NTPC Nabinagar 4 x 250 MW (BHEL W.O no: G 201, G 202, G 203 and G 204) NTPC Nabinagar 3 x 660 MW (BHEL W.O no: G 609, G 610 and G 611)	DOC.NO: BAP/QR/G201 to G204, G609 to G611/Nabinagar/ LTM/ Slurry Pumps: 001 Rev NO.: 00 PAGE : Page 2 of 7 DATE: 17.07.2020	##Enquiry No: ## OEM Supplier Name & Address: ##Offer reference: ##Date: Contact Official Name: Mobile no: Email id:
Sl. NO.	DESCRIPTION	BHEL and Ultimate Customer - NTPC (National Thermal Power Corporation),, India Quality Requirements	##Specific confirmations by the vendor

ITEM: LT Motors (IE3) Up to 200KW

01	Type Test RequirementContd	D. The following Type test reports to be submitted covering the following for above 50KW LT Motor as per relevant BIS (Bureau of Indian Standard) - BIS 325 / IEC 60034 etc i. Measuring of resistance of winding of stator and wound rotor (if applicable) ii. No load test at rated voltage to determine input current, power and speed. iii. Open circuit voltage ratio of wound rotor motor (in case slip ring motors) iv. Full load test to determine efficiency power factor and slip v. Temperature rise test. vi. Momentary excess load test vii. High voltage test viii. Test for vibration severity of motor ix. Test of 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 90dB(A).) x. Over speed test xi. Degree of Protection Tests (Minimum Ingress Protection - IP 55). xii. Type test reports for motors located in fuel oil area having flame proof enclosures as per BIS 2148/ IEC 60079-1	
		E. The TCs / Type Test reports shall also be given as PDF file with index sheet & page control through Email & Soft Copy (File size to less than 9MB).	

Annexure-I

CONTRACT QUALITY REQUIREMENTS (CQR) for LT MOTORS(IE3) Up to 200KW

(For INDIGENOUS OEM VENDOR ONLY)

PROJECT: NTPC Nabinagar 4 x 250 MW (BHEL W.O no: G 201, G 202, G 203 and G 204) NTPC Nabinagar 3 x 660 MW (BHEL W.O no: G 609, G 610 and G 611) NTPC CONTRACT NO: CS-0270-109(1A) -2-FC/19-20/1819 for Nabinagar 4 x 250 MW CS-0370-109-(1A) -2-FC -NOA-0059 1819 for Nabinagar 3 x 660 MW PACKAGE: FGD PACKAGE MAIN CONTRACTOR: BHEL - RANIPET SUB CONTRACTOR (OEM) & ADDRESS: (To be filled by OEM VENDOR)	CONTRACT QUALITY REQUIREMENTS (CQR) for LT MOTORS(IE3) - Up to 200KW NTPC Nabinagar 4 x 250 MW (BHEL W.O no: G 201, G 202, G 203 and G 204) NTPC Nabinagar 3 x 660 MW (BHEL W.O no: G 609, G 610 and G 611)	DOC.NO: BAP/QR/G201 to G204, G609 to G611/Nabinagar/ LTM/ Slurry Pumps: 001 Rev NO.: 00 PAGE : Page 3 of 7 DATE: 17.07.2020	##Enquiry No: ## OEM Supplier Name & Address: ##Offer reference: ##Date: Contact Official Name: Mobile no: Email id:
Sl. NO.	DESCRIPTION	BHEL and Ultimate Customer - NTPC (National Thermal Power Corporation),, India Quality Requirements	##Specific confirmations by the vendor

ITEM: LT Motors (IE3) Up to 200KW

02	Quality Plan Requirement	1. RQP or MQP is applicable for these LT Motor. 2. RQP/MQP (Manufacturing Quality Plan) is applicable for these LT Motors and accordingly Actual LT Motor Manufacture and OEM shall submit the RQP/MQP in ultimate customer – NTPC format. 3. If any of LT Motor manufacture is having, ultimate customer NTPC approved MQP (Manufacturing Quality Plan) / RQP (Reference Quality Plan) and having validity, the same is applicable for these LT Motor for inspection subject to obtaining ultimate customer NTPC formal approval in the event of an order through endorsement sheet approval route as in sl no: 4 below 4. Accordingly, LT Motor Manufacture & OEM supplier shall submit the filled up Endorsement sheet (copy attached) with ultimate customer approved MQP/RQP with signature & seal in the event of a Purchase Order from BHEL. 5. If LT Motor Manufacture / OEM vendor does not have MQP/RQP, they should submit a fresh MQP to BHEL/NTPC (in NTPC format) for review & approval. (copy attached).	
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Annexure-I

CONTRACT QUALITY REQUIREMENTS (CQR) for LT MOTORS(IE3) Up to 200KW

(For INDIGENOUS OEM VENDOR ONLY)

PROJECT: NTPC Nabinagar 4 x 250 MW (BHEL W.O no: G 201, G 202, G 203 and G 204) NTPC Nabinagar 3 x 660 MW (BHEL W.O no: G 609, G 610 and G 611) NTPC CONTRACT NO: CS-0270-109(1A) -2-FC/19-20/1819 for Nabinagar 4 x 250 MW CS-0370-109-(1A) -2-FC -NOA-0059 1819 for Nabinagar 3 x 660 MW PACKAGE: FGD PACKAGE MAIN CONTRACTOR: BHEL - RANIPET SUB CONTRACTOR (OEM) & ADDRESS: (To be filled by OEM VENDOR)	CONTRACT QUALITY REQUIREMENTS (CQR) for LT MOTORS(IE3) - Up to 200KW NTPC Nabinagar 4 x 250 MW (BHEL W.O no: G 201, G 202, G 203 and G 204) NTPC Nabinagar 3 x 660 MW (BHEL W.O no: G 609, G 610 and G 611)	DOC.NO: BAP/QR/G201 to G204, G609 to G611/Nabinagar/ LTM/ Slurry Pumps: 001 Rev NO.: 00 PAGE : Page 4 of 7 DATE: 17.07.2020	##Enquiry No: ## OEM Supplier Name & Address: ##Offer reference: ##Date: Contact Official Name: Mobile no: Email id:
Sl. NO.	DESCRIPTION	BHEL and Ultimate Customer - NTPC (National Thermal Power Corporation),, India Quality Requirements	##Specific confirmations by the vendor

ITEM: LT Motors (IE3) Up to 200KW

03	BHEL / Ultimate Customer – NTPC approved vendors	LT Motors are to be procured only from following Ultimate Customer - NTPC approved vendors and no deviation on this specific requirement is acceptable. ➤ KEC / Bengaluru (Up to 200KW) & Hubli (Up to 90KW) ➤ CGL/Ahmednagar (Up to 200KW) ➤ SIEMENS/Mumbai (Up to 200KW) ➤ ABB/Faridabad (Up to 55KW) and Bengaluru (Up to 200KW) ➤ BBL/Mumbai (Up to 200KW) ➤ NGEF/ Bengaluru (Up to 15KW) ➤ Marathon / Kolkatta (Up to 200KW) ➤ Jyothi / Vadodara (Up to 200KW) ➤ Laximi Hydraulics Private Limited (LHPL) / Solapur (Up to 200KW)	
04	Inspection Methodology to be adopted at Actual LT Motor Manufacture works by OEM vendor	<u>LT Motors up to 30KW – Inspection Categorization: III</u> All Routine tests on LT Motors are to be ensured by OEM Vendor & same are to be inspected & witnessed by OEM Vendor / BHEL / BHEL AIA (BHEL authorized inspection Agency) at LT Motor manufacture works as per approved MQP & approved data sheet / drg / spec/ as per relevant BIS (Bureau of Indian Standard) - BIS 325 / IEC 60034 etc and all the Routine Test Reports with Inspection report (IR) to be submitted for BHEL/Ultimate Customer – NTPC for review and to obtain inspection and dispatch clearance .	
		<u>LT Motors (30KW to 50KW) – Inspection Categorization: II</u> All Routine Tests on LT Motors are to be ensured by OEM vendor & witnessed by BHEL/BHEL AIA (BHEL authorized inspection Agency) at LT Motor manufacture works including review of Type Test Reports and Degree of Protection Test Reports (IP 55) as per approved MQP & approved data sheet/drg/spec / as per relevant BIS (Bureau of Indian Standard) - BIS 325 / IEC 60034 etc and all the Routine Test Reports with Inspection report (IR) to be submitted for BHEL/Ultimate Customer – NTPC for review and to obtain inspection and dispatch clearance .	

Annexure-I

CONTRACT QUALITY REQUIREMENTS (CQR) for LT MOTORS(IE3) Up to 200KW

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ITEM: LT Motors (IE3) Up to 200KW

04	Inspection Methodology to be adopted at Actual LT Motor Manufacture works by OEM vendor..... Contd	<u>Above 50KW and up to 200KW – Inspection Categorization: I</u> All Routine & Type Tests if any on LT Motors are to be ensured by OEM Vendor and same shall be offered to BHEL/ BHEL AIA (BHEL authorized inspection Agency) / Ultimate Customer-NTPC for inspection & witnessing including review of Degree of Protection Test Reports as per approved MQP /RQP with endorsement sheet / approved data sheet / drg / spec / as per relevant BIS (Bureau of Indian Standard) - BIS 325 / IEC 60034 etc and all the Routine Test Reports , Type test Reports including Degree of protection test report with Inspection report (IR) to be submitted for BHEL/Ultimate Customer – NTPC for review and to obtain inspection and dispatch clearance. BHEL/ BHEL AIA (BHEL authorized inspection Agency) / Ultimate Customer-NTPC to witness / perform inspection at LT Motor Supplier works and submit all the inspection documents and routine & Type test reports including Degree of Protection Test Reports (IP 55) as per approved MQP & approved data sheet / drg / spec / as per relevant BIS (Bureau of Indian Standard) - BIS 325 /IEC 60034 etc. No material shall be dispatched without BHEL / BHEL AIA and Ultimate Customer – NTPC Inspection and dispatch clearance.	
05	Painting Requirements	Painting requirement like paint shade and painting thickness including no of coats if any are to be ensured by the OEM vendor for these LT Motors as per BHEL/ Ultimate Customer -NTPC approved data sheet/drg/spec (As applicable).	
06	Packing	Packing shall be as per Specification / Drg. / Data sheet including sea worthy packing if any to avoid any transit & handling damages .	
07	For Inspection call	Inspection call by OEM Vendor for LT Motor inspection at Actual LT Motor Manufacture works to be raised for BHEL/BHEL AIA inspection / Ultimate Customer – NTPC including for type test witnessing if any to be ensured / addressed to Mr R Kesavan., DGM (QC-Proc), Mobile no: +91 9443006303., Email id: kesavan@bhel.in and Mr Kovarathanan., DM (QC-Proc), Mobile no: +91 8903502628., Email id: kovak@bhel.in including for inspection related activities for immediate response / resolution.	

Annexure-I

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ITEM: LT Motors (IE3) Up to 200KW

08	Document Package / Dossier	Specific confirmation for Document Package in the event of an order (3 hard copies + soft copies in PDF file) is to be given containing the following with proper linkages (.) (i) Index Sheet (ii) MQP/RQP/Endorsement sheet (iii) TCs identified by BHEL/NTPC for record for “CHP” (Customer Hold Point) Verification & Witness “W” portion as given in MQP / RQP / MQP (as applicable). (iv) Final Inspection Report + TC (v) BHEL AIA (BHEL Appointed Inspection Agency) / BHEL report + TC (vi) Ultimate customer NTPC (National Thermal Power Corporation) CHP (Customer Hold Point) / MDCC (Material Dispatch Clearance Certificate) (vii) Type test reports conducted/submitted with approval with approved data sheet and BOM with actual make used with Customer approved drgs.	
09	Important notes	<u>Inspection Categorization: I</u> Inspection by BHEL/BHEL AIA and also by Ultimate Customer – NTPC based on MQP/RQP approved and as in sl no:04 <u>Inspection Categorization: II</u> Inspection by Main contractor (BHEL) / BHEL AIA based on Ultimate Customer – NTPC approved MQP/RQP & based on inspection as in sl no:04 <u>Inspection Categorization: III</u> COC by Main contractor (BHEL) to Ultimate Customer – NTPC based on inspection as in sl no:04. Any cost implication for conducting checks / tests including for witnessing of any of the tests at Actual LT Motor Manufacture Works by BHEL / BHEL AIA / Ultimate Customer – NTPC is in the scope of OEM Supplier only and no extra cost if any will be admissible in the event of an order and also during execution of the contract.	

Annexure-I

CONTRACT QUALITY REQUIREMENTS (CQR) for LT MOTORS(IE3) Up to 200KW

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10	Motor details Vendor shall furnish following Motor details for the Pumps applicable for this enquiry. NTPC Nabinagar 4 x 250 MW – FGD Project:- <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 5%;">S. No</th> <th style="width: 45%;">Pump</th> <th colspan="3" style="width: 50%;">LT Motor</th> </tr> <tr> <th></th> <th></th> <th style="width: 20%;">Rating (in kW)</th> <th style="width: 15%;">Quantity</th> <th style="width: 15%;">Proposed Make</th> </tr> </thead> <tbody> <tr><td>1</td><td>Limestone Slurry Feed Pump</td><td></td><td></td><td></td></tr> <tr><td>2</td><td>Gypsum Bleed Pump</td><td></td><td></td><td></td></tr> <tr><td>3</td><td>Primary Hydro-cyclone Feed Tank Pump</td><td></td><td></td><td></td></tr> <tr><td>4</td><td>Filtrate Water Tank Pump</td><td></td><td></td><td></td></tr> <tr><td>5</td><td>Secondary Hydro-cyclone Feed Tank Pump</td><td></td><td></td><td></td></tr> <tr><td>6</td><td>Waste Water Tank Pump</td><td></td><td></td><td></td></tr> <tr><td>7</td><td>Auxiliary Absorbent Tank Pump</td><td></td><td></td><td></td></tr> <tr><td>8</td><td>Emergency Transfer Pump</td><td></td><td></td><td></td></tr> <tr><td>9</td><td>Absorber Area Drain Sump Pump</td><td></td><td></td><td></td></tr> <tr><td>10</td><td>Gypsum Area Drain Sump Pump</td><td></td><td></td><td></td></tr> <tr><td>11</td><td>Limestone Area Drain Sump Pump</td><td></td><td></td><td></td></tr> <tr><td>12</td><td>Other LT motors involved in the system (if any)</td><td></td><td></td><td></td></tr> </tbody> </table> NTPC Nabinagar 3 x 660 MW – FGD Project:- <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 5%;">S. No</th> <th style="width: 45%;">Pump</th> <th colspan="3" style="width: 50%;">LT Motor</th> </tr> <tr> <th></th> <th></th> <th style="width: 20%;">Rating (in kW)</th> <th style="width: 15%;">Quantity</th> <th style="width: 15%;">Proposed Make</th> </tr> </thead> <tbody> <tr><td>1</td><td>Limestone Slurry Feed Pump</td><td></td><td></td><td></td></tr> <tr><td>2</td><td>Gypsum Bleed Pump</td><td></td><td></td><td></td></tr> <tr><td>3</td><td>Primary Hydro-cyclone Feed Tank Pump</td><td></td><td></td><td></td></tr> <tr><td>4</td><td>Filtrate Water Tank Pump</td><td></td><td></td><td></td></tr> <tr><td>5</td><td>Secondary Hydro-cyclone Feed Tank Pump</td><td></td><td></td><td></td></tr> <tr><td>6</td><td>Waste Water Tank Pump</td><td></td><td></td><td></td></tr> <tr><td>7</td><td>Auxiliary Absorbent Tank Pump</td><td></td><td></td><td></td></tr> <tr><td>8</td><td>Emergency Transfer Pump</td><td></td><td></td><td></td></tr> <tr><td>9</td><td>Absorber Area Drain Sump Pump</td><td></td><td></td><td></td></tr> <tr><td>10</td><td>Gypsum Area Drain Sump Pump</td><td></td><td></td><td></td></tr> <tr><td>11</td><td>Limestone Area Drain Sump Pump</td><td></td><td></td><td></td></tr> <tr><td>12</td><td>Other LT motors involved in the system (if any)</td><td></td><td></td><td></td></tr> </tbody> </table>	S. No	Pump	LT Motor					Rating (in kW)	Quantity	Proposed Make	1	Limestone Slurry Feed Pump				2	Gypsum Bleed Pump				3	Primary Hydro-cyclone Feed Tank Pump				4	Filtrate Water Tank Pump				5	Secondary Hydro-cyclone Feed Tank Pump				6	Waste Water Tank Pump				7	Auxiliary Absorbent Tank Pump				8	Emergency Transfer Pump				9	Absorber Area Drain Sump Pump				10	Gypsum Area Drain Sump Pump				11	Limestone Area Drain Sump Pump				12	Other LT motors involved in the system (if any)				S. No	Pump	LT Motor					Rating (in kW)	Quantity	Proposed Make	1	Limestone Slurry Feed Pump				2	Gypsum Bleed Pump				3	Primary Hydro-cyclone Feed Tank Pump				4	Filtrate Water Tank Pump				5	Secondary Hydro-cyclone Feed Tank Pump				6	Waste Water Tank Pump				7	Auxiliary Absorbent Tank Pump				8	Emergency Transfer Pump				9	Absorber Area Drain Sump Pump				10	Gypsum Area Drain Sump Pump				11	Limestone Area Drain Sump Pump				12	Other LT motors involved in the system (if any)			
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OEM Supplier signature with seal

Necessarily to be filled up & submitted by the OEM vendor at the time of offer itself otherwise the offer may not be considered w.r.t Quality Requirements against LT Motors being BHEL/ ultimate customer – NTPC (National Thermal Power Corporation Limited) specific requirements.