

ESP-001- 2A Rev.00	 	PROJECT ENGINEERING & SYSTEMS DIVISION BHARAT HEAVY ELECTRICALS LIMITED RAMACHANDRAPURAM: HYDERABAD - 502 032	Std. / Doc. Number	
			PY51588	
			Rev. No.	00

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DOCUMENTS TO BE SUBMITTED WITH THE BID:

The bidder must submit the following documents along with their bid for each Pump, so as to enable BHEL to evaluate their offer.

- 1) Duly filled in Pump-Motor datasheet as per Annexure-2
- 2) Tentative GAD for Pump with Motor
- 3) Performance curves for pump
- 4) Un-priced copy of price in attached BHEL price bid formats indicating quoted/ not quoted against each row & column as per Annexure-3
- 5) Equipment qualification criteria / PTR / Reference Lists
- 6) Checklist as per Annexure-4
- 7) No Deviation certificate as per Annexure-9

In case the above mentioned documents are not submitted with the offer, the offer of the bidder may be liable for technical rejection.

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1.0 INTENT OF SPECIFICATION:

This specification specifies the requirement of Design, Engineering, Manufacturing, Assembling, Inspection, testing at manufacturer's works and Delivery of properly packed and painted for transport of Centrifuge Feed Pump with drives and all accessories as specified in the scope of work and as required for the safe and trouble-free operation of equipment to be installed at site.

2.0 SPECIAL NOTES TO BIDDERS:

2.1 This specification shall be read in conjunction with its enclosures. In case of any discrepancy arising between this specification & its enclosures, the most stringent of all shall be followed and shall over-ride others. Further, if a requirement in this specification or its enclosures, calls for decision of BHEL, it shall be bidder's sole responsibility to clearly bring out the same distinctively in his technical tender offer, so as to enable BHEL to furnish their decision. If such a requirement is not duly addressed by bidder during tender stage and same comes out during order execution stage, it shall be binding on the bidder to comply with the decision furnished by BHEL then, without any cost, delivery, or any other commercial implications.

a) Bidders shall comply with various requirements of this specification. Bidders can bring out only those deviations which are impractical to meet, for our review.

b) Bidders may please note that unless the deviations are specifically brought out under deviations clause, it will be considered that no deviations are taken, even if they are mentioned elsewhere directly/indirectly in the offer.

2.2 Any additional equipment, material, etc., which are not specifically mentioned here, but are required to make the supplied equipment complete in all respect, in accordance with the intent of this technical specification, contractual agreement, statutory requirements, relevant/applicable codes/standards, good engineering practices, and for safe and trouble-free operation, shall be deemed to be covered under the scope of this specification.

2.3 The Bidder shall accept full responsibility for the completeness and for the faultless working of all the equipment. These shall be executed on the basis of proven design principle and in accordance with the latest state of the art in such a manner that the purpose to be served by the Pump unit is fulfilled in every respect and a maximum of operational dependability and efficiency are assured. Standardization of equipment, materials etc. shall be employed in the design. Care shall be taken to ensure safe operation as well as simplicity of assembling and dismantling of all parts of the plant.

2.4 Bidder shall quote strictly as per the scope of supply and requirements of this specification.

2.5 Bidder offer shall be strictly as per these specification requirements. Unsolicited or Alternate offers from the bidders will not be entertained.

2.6 In case bidder feels that it is necessary to exclude some components of scope of supply or some of the features of specification requirements due to any technical constraints, bidder shall bring the same to the notice of purchaser during pre-bid stage and take their prior approval before submission of their bid.

2.7 Incase Bidder is unable to offer due to any specific requirement of specification. Bidder shall bring out the same in their regret letter. Otherwise it will be considered that non participation by the bidder is attributable to reasons other than any specification requirements.

3.0 APPLICATION OF SYSTEM:

2 Nos. [1 Working +1 Standby] of Sludge Lifting Pumps is envisaged for feeding Sewage from Sludge Sump to Centrifuge for mechanical dewatering.

4.0 TECHNICAL DETAILS/REQUIREMENTS:

a) Design Parameters and Technical Requirement of the Raw Sewage Lifting Pumps Type-1:

Sl. No.	Description	Unit	Rated Condition
1	Liquid		Biological Sludge of 0.8 – 1% Solids Consistency
2	Temperature Of Raw Sewage	Deg. C	Min. 20 Deg. C
3	Specific Gravity		1.05
4	Solid Size		Up to 40 mm
5	Quantity		2 Nos. (1 Working + 1 Standby)
6	Capacity of each pump	m ³ /hr	9.6
7	Pump Differential Head (At Discharge Flange)	mwc	15
8	Drive (Pump Supplier Scope)		Motor [IE 3 Motor]
9	Speed of Pump	rpm	Not more than 1500 rpm
10	Pump Type		Positive displacement type Screw Pumps (Horizontal)
11	Application		Handling Sludge
12	Sealing		Mechanical seal as per OEM standard
13	Duty		Continuous

15	Material of Construction: • Pump housing: SS : CI IS 210 Gr. FG 260 • Rotor: SS AISI 316 (hard chrome Plated) • Shaft: SS : SS AISI 410 (hard chrome Plated) • Stator: Nitrite Black • Base plate: MS Fabricated • Mechanical Seal: Silicon Carbide, • Seal faces: The Primary (Inboard) seal should be of Silicon Carbide or Tungsten Carbide faces. The Secondary (Outboard) seal should be of Carbon v/s Cast Chrome Molybdenum Steel or Silicon Carbide or Tungsten Carbide – i.e., Thermally Unstable materials like Alumina/ Aluminum Oxide shall not be allowed. • Motor: Aluminum Die Cast Rotors but Dual Cage Copper Bar shall be preferred. Other Components as per Manufacturer standard. * In case bidder can't meet above mentioned material, Bidder can offer Equivalent/Superior material suitable to the requirement.	
16	Power Supply	3 Ph,415 V,+/- 10% Voltage Variation, 50Hz,+/- 5% Frequency variation, Combined Variation: +/- 10%, [Starter feeder: DOL]
17	Motor Rating	The Motor Rating should be higher of the two criteria i.e.,10% over Maximum pump shaft input at any point of the curve &/or 20% over pump shaft input @ duty point
18	Insulation/Protection/No. of Starts	Class-F/IP55/Min 10 starts/stop per hour
19	Temperature rise	The temperature rises shall not exceed the values given in IS 12802. Under extremes of supply condition (clause 4.1 above), the temperature rise shall not exceed the value indicated in IS by 10°C.
20	Noise Level	Max. 85 dBA @ 1.86 m from pump drive
21	Vibration Level	All rotating equipment without reciprocating parts of motor rating ≤ 15 kW : 1.12 mm/sec All rotating equipment without reciprocating parts of motor rating > 15 kW & ≤ 75 kW: 1.8 mm/sec All rotating equipment without reciprocating parts of motor rating > 75 kW : 2.8 mm/sec

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Other special feature:

- a) The rotor material shall be selected and abrasion resistance for the fluid being pumped, and for prolonged service life. Hard chrome of other approved coating shall be not less than 250 micron thickness and shall be diffused in to the base material. The pump set shall be suitable for starting with discharge valve open and/or closed.
- b) Motor bearings shall have an estimated life of at least 70,000 hrs.
- c) All Equipment including electrical shall be designed for ambient temperature of 50 Deg. C.
- d) Pumps shall be fitted with individual dry-running protection to initiate pump trip. Dry-running protection by 'under-current' monitoring of 'pipeline-intrusive' device shall not be used.

5.0 SCOPE OF SUPPLY:

The scope of supply for this enquiry is as given below:

Please refer to the enclosed Schematic for Submersible Pump (Annexure-1) for general clarity on scope of supply. The system shall be provided as per annexure-1 taking into all requirements including for testing, painting, documentation, sub vendor list, equipment specifications etc., specified in this specification and enclosures.

Quantity of Pump with drive assembly are as follows:

2 Nos. Centrifuge Feed Pump (Positive Displacement Type Screw Pump).

The scope of supply for each pump & motor drive assembly is as given below:

5.1 Pump:

Centrifuge Feed Pump (Positive Displacement Type Screw Pump-Horizontal) complete with all accessories as per specification & required accessories for smooth running of pump assembly. Performance requirement, Design and construction of the pump shall be guided by the Manufacturer standard.

These pumps shall be of screw type used for pumping sludge to centrifuge. The pumps shall be designed to operate satisfactorily without detrimental surges, vibration, noise, or dynamic imbalance. Over the required head range, the head-capacity curve of the pump shall have a continuously rising head characteristic with decreasing capacity over the whole range of total head. The pump shall have the maximum efficiency at the specified duty point. The unit shall be designed to operate safely at the maximum speed attainable in the reverse direction of rotation due to sewage returning through the pump at times when power supply of the motor is interrupted.

All rotating parts shall be statically and dynamically balanced as per ISO standards.

A stationary coupling guard shall be provided for the coupling conforming to all relevant safety codes and regulations. Guards shall be designed for easy installation and removal. They shall be complete with necessary support accessories and fastener.

The pumping unit shall be provided with a common base plate. The base plate shall be of sufficient size and rigidity to maintain the pump and motor in proper alignment and position.

For details, please refer to the enclosed annexures.

5.2 Motor:

Selection Criteria:

The rating of the motor shall be the larger of following:

- a) 15% of power required by the pump at the duty point
- b) 110 % of maximum power required by the pump from zero discharge to the runout point.
- c) Power requirement at 110% safety valve overpressure.

Technical details:

The design, material, construction, manufacture, inspection, testing and performance of induction motors shall comply with IS 325/IEC60034. Energy Efficient Class shall be IE 3 as per IS 12615. The supply voltage level shall be 415 V.

The motor shall be squirrel cage type, suitable for three phase supply continuous duty with class 'F' insulation. The temperature rises shall not exceed the values given in IS 12802. Under extremes of supply condition , the temperature rise shall not exceed the value indicated in IS by 10°C.

Motors of 3000 rpm are not acceptable. In turn the bidder shall not consider pumps/ drives of 3000 rpm/ 2900 rpm. 2 pole motor shall not be considered anywhere in the project.

All the motors shall have overloading capacity as per latest revision of IS.

Following to be noted:

- 1 No 415V Power supply DOL feeder shall be provided to each motor .
- Actual cable sizes will be intimated during detailed engineering.

- Suitable terminals shall be provided by supplier in motor terminal box.
- 1 no. of Local control station for each motor shall be provided for local ON/OFF purpose.
- At motor end complete cable glands & lugs are in supplier scope.
- Glands shall be double compression type nickel plated brass(ET) and lugs shall be tinned copper heavy duty type.

For details, please refer to the enclosed annexures.

5.3 Coupling:

Coupling between pump and motor shall comply with the following.

- a) Coupling shall be as per as per manufacturer's standard
- b) Metallic, Non-lubricated, flexible element type [diaphragm or disc type],
- c) With Non sparking type coupling guard
- d) With spacer (Min. Length to be considered depends on distance required for mechanical seal removal without disturbing pump motor unit)
- e) With a minimum service factor of 1.5

5.4 Sealing:

Mechanical Seal as per OEM standard.

Pumps shall be arranged generally with a single shaft seal at the suction end. Mechanical seals shall be used. If a flexible shaft is used to accommodate the eccentric motion, a corrosion resistant shroud shall be fitted to prevent fibre build-up on the shaft.

5.5 Relief valve:

1 no of Relief Valve at outlet of each Pump shall be included in bidder scope.

5.6 Inter connecting Piping & Instrumentation:

- a) BHEL Discharge Pipe Size: Refer Annexure-1. Accordingly, suitable Reducer/expander in order to meet BHEL discharge pipe to be included in bidder scope.
- b) Flanges & Counter flanges with necessary gaskets & bolts at all terminal points. All counter flanges shall be of weld neck type.
- c) Flanges: ASTM A234 Gr. WPB or ASTM A105 or equivalent.

- d) Fittings: The material shall conform to ASTM A234 Gr. WPB or ASTM A105 or equivalent and dimensional standard conforming to ANSI B 16.9 (socket & threaded type), ANSI B 16.22 (for flanges and flanged fittings).
- e) The fittings shall be galvanized as per IS: 4736 for galvanized pipe application.

5.7 Necessary foundation bolts, nuts, shims/grouting pads etc.

5.8 Instrumentation:

Bidder to consider required instrumentation (other than specified in specification), which are required for smooth & trouble free operation as per manufacturer recommendation.

5.9 All other items necessary for safe and smooth running of pump & Accessories required to make the supplied equipment complete in all respect.

5.10 Glands and lugs for power cable, control cable, Space heater cable and earthing cable (if any) suitable at motor end has to be supplied along with the main equipment. Glands shall be weather proof (as per motor category) double compression type Nickel plated Brass (ET) shall be provided with back nut and PVC shroud. Lugs shall be tinned copper heavy duty lug Cable dimensions shall be furnished during detail engineering, accordingly glands, lugs shall be supplied.

5.11 Commissioning Spares:

Two sets (One set for each pump & motor assembly) of commissioning spares shall be quoted and included in scope of supply as per manufacturer's recommendation.

Special notes on commissioning spares:

Bidder to furnish the list along with the offer regarding requirement of commissioning spares.

Bidder shall include all the required commissioning spares in their scope of supply and ensure that the erection and commissioning of the plant is not delayed for want of Commissioning spares.

Any leftover (unused) spares after commissioning, out of those included by vendor, shall be handed over to the owner.

Prices for the commissioning spares shall be part of main scope of supply. No separate price shall be offered for the same.

Note: Any commissioning spare consumed over and above the recommended commissioning Spares, during commissioning shall be supplied free of cost by the equipment vendor

5.12 Mandatory Spares: Not Applicable

5.13 O&M Spares:

Bidder to include following O&M spares in their scope of supply:

- a) Mechanical seal
- b) O-rings & gaskets
- c) Bearing

Bidder to include 2 sets (1 set/ pump assembly) of O&M spares (as mentioned above) in their scope of supply.

Note: The word "set" means the quantity required for full replacement of that part in one machine.

5.14 Special Tools and Tackles:

Bidder shall furnish all special tools, wrenches etc. with necessary tools boxes as required for operation and maintenance [disassemble, assemble, or maintaining the unit] as a part of scope of supply. Bidder shall furnish a list of such tools along with offer for the system. Prices for the special tools and tackles shall be part of main scope of supply.

Bidder to include 2 sets (1 set/ pump assembly) special tools & tackles (as mentioned above) in their scope of supply.

5.15 SUPERVISION OF ERECTION & COMMISSIONING:

Supervision of erection, commissioning of the supplied system shall be included in bidder's scope.

Bidder to note that the supervision charges for erection & commissioning shall consists of the following:

For the purpose of tender (L1 bidder evaluation), total no of 2 Man days to be covered in 1 Visit have been considered for supervision of E&C,

Notes:

- a) However, either or both of the number of man days or number of visits may change on either side based on the actual site requirement.
- b) All payments towards supervision of E&C shall be made only after BHEL-site certification.
- c) Bidder to mobilize concerned competent person for supervision of Erection & commissioning activities within a period of 7 days of receipt of intimation in this regard by BHEL.
- d) Bidder to quote supervision of erection and commissioning activities strictly as per BHEL's price format

5.16 OPTIONAL PRICES:

Please Refer to Attached Price Bid Format. Recommended spares list for 10 Years normal operation for Pump, Drive & other accessories.

(1 set stands for quantity required for the replacement of one pump, drive (or) accessories).

6.0 EQUIPMENT QUALIFICATION CRITERIA (EQC)

The bidder shall be an established manufacturer of positive displacement type Screw Pump (Horizontal) & having adequate engineering, manufacturing & testing facilities for Positive displacement type Screw Pump (Horizontal) confirming to the relevant applicable codes and standards. The Positive displacement type Screw Pump (Horizontal) model offered shall be from the existing regular manufacturing range of bidder.

The offered Positive displacement type Screw Pump (Horizontal) model shall meet the minimum service & manufacturing experience specified as below:

Positive displacement type Screw Pump(Horizontal) shall be identical or validly similar in terms of

- a) Type i.e. Positive displacement type Screw Pump(Horizontal)
- b) Capacity/Flow Rate
- c) Materials etc.
- d) Application.
- e) Model No.

as compared to at least 2 Units of the proposed model designed, manufactured, tested and supplied from the proposed manufacturing plant in the last 10 (ten) years from the date of Technical bid opening and at least One of these units shall supplied operated in the field for at least 8000 hours individually without any major problem as date of issue of enquiry. As a proof for the same, Date of Supply/ Commissioning report/Customer Satisfaction report will be considered and same to be provided by vendor.

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Accordingly, Bidder to furnish reference list for the Positive displacement type Screw Pump (Horizontal) consisting of year of supply, application, Customer Name, Quantity etc. as a minimum .

7.0 QUALITY PLAN & INSPECTION AGENCY & TESTING:

For details, refer enclosed annexures.

Quality Plan:

Quality plan will be reviewed during detailed Engineering stage with respect to inspection, standard Engineering practices & specification requirements and various tests and stages of inspection and appropriate agencies for Inspection will be Intimated. Bidder to abide by the same.

Pl refer Annexure-6 for ITPs. For details, refer Customer specifications, Annexure-5.

Inspection agency:

As per manufacturer standard.

In case inspection is offered, Inspection shall be carried out by BHEL/Third Party appointed by BHEL. The various review/witness/observation stages by Individual agencies (or) Group of Agencies as above will be in line with approved quality plan.

Functional test: Bidder to conduct functional test as a minimum.

Material Test Report: Material test report to be furnished for BHEL review.

8.0 PAINTING:

Steel and cast iron parts shall be sand blasted to near white cleaning before painting. Edges, sharp corners etc. shall be grounded to a curve before sand blasting. A primer coat of a zinc rich epoxy resin based coating with at least 75 microns dry film thickness is to be provided. In addition, the parts for wet duty are to be provided with an adequate number of coats of coal tar epoxy polyamine coating to a dry film thickness of 175 microns excluding primer coating. For details, refer enclosed annexures.

Paint shade shall be 631 of IS-5(Tentative). Final paint shade shall be informed during detailed engineering.

9.0 PACKING AND FORWARDING:

As per Manufacturer standard (Domestic/Seaworthy packing in case of import). For details, refer enclosed annexures.

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10.0 SUB VENDORS:

Bidder shall follow approved sub vendors list as per Annexure: 7

In case of any specific practical difficulty, bidder is requested to bring out the same with proper reason for not following vendor list [Annexure: 7] and to furnish Proven Track record , credentials for the proposed vendors for BHEL approval.

For other items for which sub vendors are not specified, bidder can follow their standard vendors with due intimation to BHEL during detailed engg stage. Also they have to ensure the Proven Track record of the sub vendors and Bidder to take prior approval of BHEL for the same.

11.0 INSTRUCTIONS ON PRICE BID FORMAT

Bidder to indicate his offer as per Price Bid format enclosed as Annexure: 3.

All the items included in the price bid format shall be quoted as per tender specification and pre-bid clarifications as per Annexure: 10, if any. Responsibility of ensuring correctness & completeness of scope of supply as per specification requirement solely lies with bidder.

The equipment supplied shall be complete in all respects. The bidder shall not be eligible for any extra payment in respect of such mountings, fittings, fixtures and accessories if required for the safe and reliable operation of the equipment. Any additional equipment, material, etc., which are not specifically mentioned here, but are required to make the supplied equipment complete in all respect, in accordance with the intent of this technical specification, contractual agreement, statutory requirements, relevant/applicable codes/standards, good engineering practices, and for safe and trouble-free operation, shall be deemed to be in bidder scope Only.

Main offer consists of those items which will be part of main order after successful bidder is identified. Optional Items consists of those items which need to be quoted by bidder but may or may not be ordered by BHEL. Bidders are instructed to provide the pricing details listed under Main offer and Optional items as per the prescribed format. Prices quoted by the bidder shall remain firm till the successful handing over of the entire package to end customer. Any request for upward revision of price during any intermediate stage before handing over the plant to end customer will be summarily rejected by BHEL.

12.0 PRE-BID CLARIFICATIONS & DEVIATIONS:

Bidders shall comply with various requirements of this specification. It may please be noted that the requirements specified here in this specification are the standard practices being followed by the bidders. However, same things are presented in a structured form so that it can be ensured that the requirements of ultimate customer are complied with.

Bidders can bring out only those deviations which are impractical to meet, for our review in pre bid clarification only.

Bidders may also please note that the data sheets for valves, instruments etc., submitted along with the offer will be considered as indicative only, as the requirements specified in the specification are standard in nature. These will not be reviewed by BHEL before award of contract. Same will be reviewed during order execution stage in line with the requirements of specification and agreed deviations.

All pre-bid clarifications & deviations shall be clear bring as per Annexure: 10 only.

In case bidder doesn't bring any clarification/deviation in prebid stage, the same shall be brought in their offer with following conditions:

- Any deviations to Customer specifications, same are acceptable provided these deviations are also regularly accepted by Customer for their direct orders on bidders. In such cases, proof of the same shall be furnished along with the offer.
- Bidders may please note that unless the deviations are specifically brought out under deviations clause, it will be considered that no deviations are taken, even if they are mentioned elsewhere directly/indirectly in the offer.
- Price implication due to non-acceptance [by BHEL/Customer] of the deviations considered by bidder will not be permitted.
- Deviations [if any] shall be clear bring as per Annexure: 9 only.

13.0 DOCUMENTATIONS

Please refer to enclosed Master Documentation List [MDL] for the list of DOCUMENTS / DRAWINGS to be submitted by the bidder as part of documentation. Bidder shall ensure submission of all documentation as per the MDL, Annexure: 8.

Bidder to note that the dates of submission of all the documents shall be finalized based on PO date. It shall be solely bidder's responsibility to get approval on the entire document from purchaser to meet project schedule.

DEFINITION OF VENDOR DOCUMENT REVIEW STATUS ASSIGNED BY BHEL

The guidelines listed below are followed in assigning the document status code to the vendor documents: Final submittal of vendor documents will not be required as long as the document status code is 1 or 4 and the "AS-BUILT" condition of the component agrees with the current document.

Permission to proceed does not constitute acceptance or approval of design details, calculations, analyses, test methods, or materials developed or selected by the vendor and does not relieve the vendor from full compliance with contractual obligations.

Code-1: Work may proceed

The document conforms to procurement document requirements. The document requires no changes or additions. Matters remaining to be resolved do not require document change and will be handled by correspondence. Where it is known that the design information on a vendor document is not complete and re-submittals will be required, e.g., due to "hold" areas, the document is assigned another status code.

Code-2: Revise and resubmit

Work may proceed subject to resolution of indicated comments. The document is in basic conformance with procurement document requirements. Minor deviations from procurement document requirements have been noted or other minor technical or physical changes in the equipment are required. The vendor shall resolve comments and resubmit documents prior to shipment of commodity.

Code-3: Rejected. Revise and resubmit

The document:

- Does not conform to the procurement requirements,
- Is of a design that is technically unacceptable without significant changes,
- Does not meet project requirements, i.e., orientation of equipment, nozzles, conduit connections, etc.,
- Does not conform to project criteria or with proposal documents or data, or
- Does not meet minimum submittal requirements.

This submittal rejection does not relieve vendor of any schedule commitments.

Code-4: Review not required

The document is not subject to BHEL review. Typical uses for this status are in the review of items that are vendor standard products, small internal parts of major equipment, or vendor standardized data.

DRAWINGS REVIEW & APPROVALS:

Each drawing submitted by the bidder shall be with a title block furnished by BHEL during detailed engg stage.

All drawings / documents shall be thoroughly checked, duly signed, and stamped by the vendor including drawing /documents of sub-vendor, before submission to BHEL. Documents, which are unchecked, unsigned, and without revisions marked clearly, shall be returned without review. Any delay on account of this shall be to the vendor's account. After first review of documents, vendor to submit all the further revisions of documents along with comment

resolution sheet. Successive documents submitted without comment resolution sheet shall be returned without review.

The approval and /or review by BHEL /End customer shall not be construed by the bidder as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and drawings.

Documents once reviewed in Code-1 shall not be submitted (incorporating some changes) again for review, however if some change is really necessary, the same shall be brought to the notice of BHEL separately through design change note for review / information. Finally, As – built drawings, duly updated, shall be submitted.

During detailed engg stage, BHEL shall furnish check list reg minimum contents in GA drawing. Bidder to submit GAD [duly incorporating all requirements as per the check list] along with signed checklist. GAD shall not be reviewed without duly filled in checklist signed by the bidder.

NO. OF COPIES OF EACH DOCUMENT TO BE FURNISHED:

All the documents shall be submitted as given below:

SL NO.	DESCRIPTION	NO. OF COPIES / PIECES TO BE SUBMITTED	WHEN TO SUBMIT
1)	Initial drawings/documents under approval and information category.	Soft copy only	Within 2 weeks of placement of order
2)	BHEL shall furnish their observation on submitted	Soft copy only	Within 2 weeks of document submission
3)	*Revised drawings/documents along with compliance sheet incorporating all BHEL comments. <i>*Vendor to incorporate all BHEL comments so that further revisions can be minimized.</i>	Soft copy only	Within 1 weeks of receipt of commented Drawings from BHEL
4)	BHEL shall furnish their observation on submitted	Soft copy only	Within 2 weeks of document submission
5)	Final Drawings/documents	12	Within 2 months of placement of order.

Referring to sl no 2 as mentioned above, pl note that BHEL shall furnish code-1or 2, if the drawing submitted by the vendor meeting specification requirement.

6)	Erection Documentation	5	1 month before dispatch of equipment. The list of documents identified under master document list for erection to be furnished in 5 no's of folders
7)	Draft O & M Manuals for BHEL review. <i>Note: Bidder to furnish final hard copy of O&M only after getting</i>	Soft copy	At least 2 months before the delivery date of equipment
8)	Revised O & M Manuals with Test Certificates to be submitted to BHEL (Hyderabad)	12	Within one month before the delivery date of equipment
9)	Final O&M manuals in a CD	4	Within one month after dispatch of equipment after BHEL concurrence on soft copy.

Notes:

The O&M manuals shall contain the following as minimum:

- The identification details of the equipment like BHEL P.O. No., Vendor's Job Identification No., full contact address with telephone, fax, & e-mail details.
- Brief description of the system.
- All approved documents [Drawings, documents & test procedures as per MDL]
- Bill of material, BBU, LO schedule, sub vendor list, Mandatory & commissioning spares list etc.
- Operation, Instruction & maintenance manuals of all equipments / items fo the complete package
- System unloading, storage erection, start up, commissioning, shut down requirements.
- Operational & environmental safety instructions.
- Test reports and certificates.
- Catalogues of the equipment & instrumentation.

14.0 VARIANT TABLE:

Variant	Item	Material Code
01	Centrifuge Feed pump	PY9751588014
02	Centrifuge Feed pump -Supervision of E&C	PY9851588024
03	Centrifuge Feed pump - O&M spares	PY9751588030

RECORD OF REVISIONS

Rev. No.	Date	Revision Details	Revised By	Approved By
00	02.08.19	First Issue	-----	M.Siva Prasad Babu

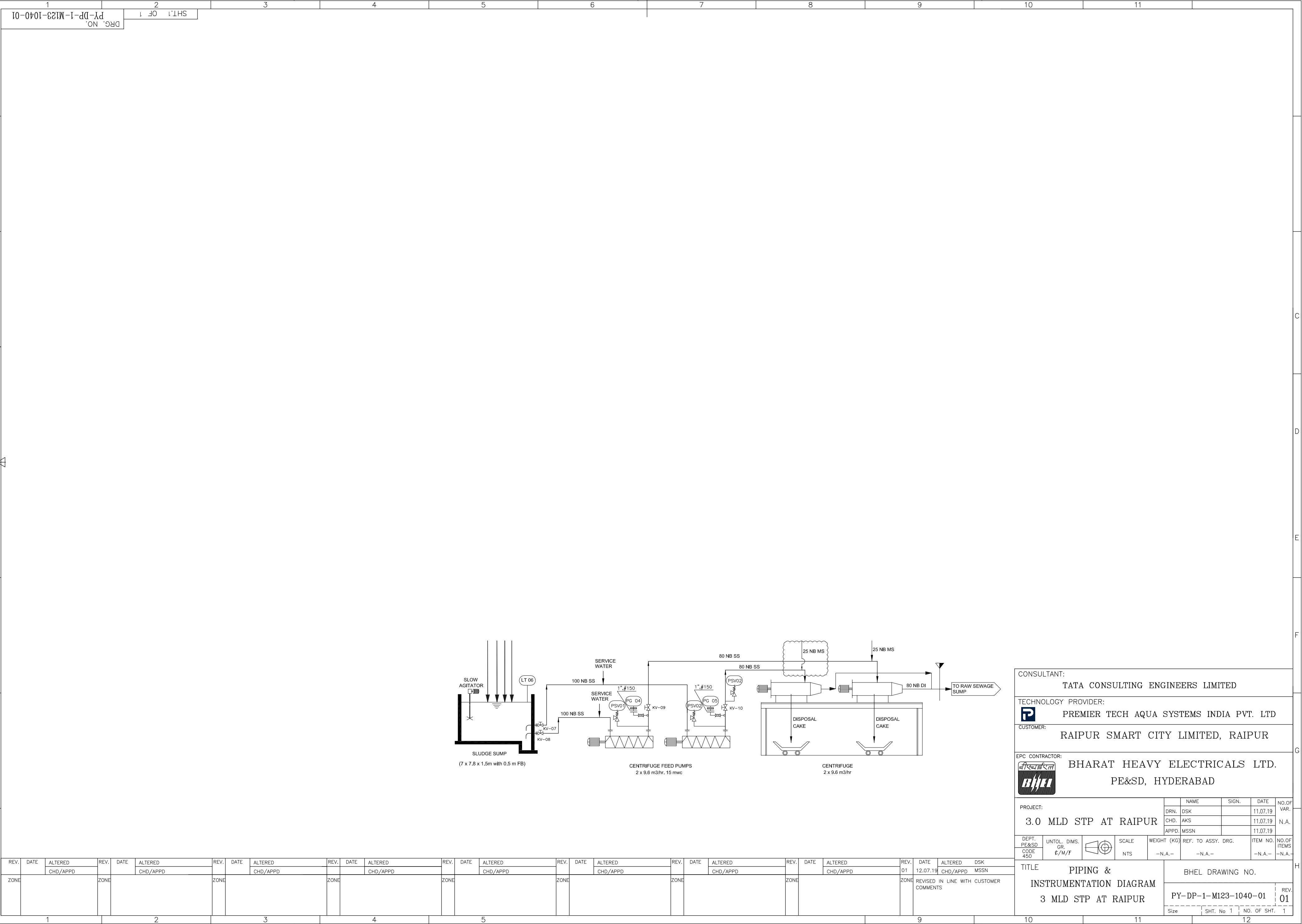
ESP-001- 2A Rev.00	 	BHARAT HEAVY ELECTRICALS LIMITED PROJECT ENGINEERING & SYSTEMS DIVISION RAMACHANDRAPURAM: HYDERABAD - 502 032	Std. / Doc. Number	
			Annexure-1	
			Rev. No.	00

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Revisions:	Prepared by :	Checked by :	Approved by :	Date :
Refer to record of revisions	Girish Prasad Palo	Siva Prasad Babu	Siva Prasad Babu	06.05.2019

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INVENTORY NO. SIGN. AND DATE REF. DRG. NO. COMPUTER FILE NAME



CONSULTANT:
TATA CONSULTING ENGINEERS LIMITED

TECHNOLOGY PROVIDER:
 PREMIER TECH AQUA SYSTEMS INDIA PVT. LTD

CUSTOMER:
RAIPUR SMART CITY LIMITED, RAIPUR

EPC CONTRACTOR:
 BHARAT HEAVY ELECTRICALS LTD.
PE&SD, HYDERABAD

PROJECT:	NAME	SIGN.	DATE	NO.OF VAR.
3.0 MLD STP AT RAIPUR	DRN.	DSK	11.07.19	
	CHD.	AKS	11.07.19	N.A.
	APPD.	MSSN	11.07.19	

DEPT. PE&SD	UNTOL. DIMS. GR. C/M/F	SCALE NTS	WEIGHT (KG) -N.A.-	REF. TO ASSY. DRG. -N.A.-	ITEM NO. -N.A.-	NO.OF ITEMS -N.A.-
450						

TITLE	BHEL DRAWING NO.
PIPING & INSTRUMENTATION DIAGRAM 3 MLD STP AT RAIPUR	PY-DP-1-M123-1040-01
	REV. 01

Size

SHT. No 1

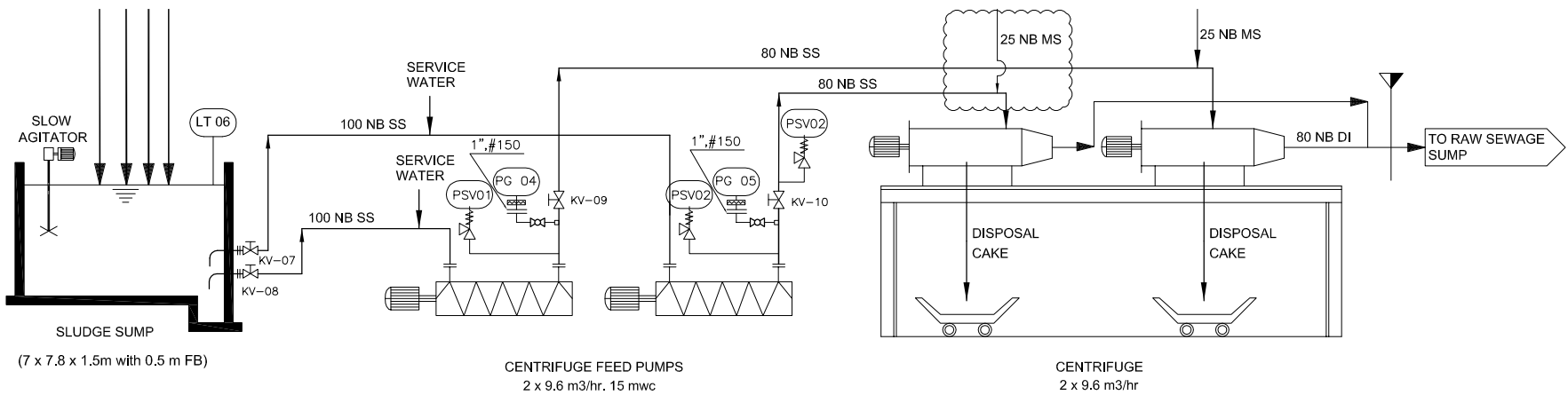
NO. OF SHT. 1

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INVENTORY NO. SIGN. AND DATE REF. DRG. NO. COMPUTER FILE NAME

1
PY-DP-1-M123-1040-01
DRG. NO.

2
SHT. 1 OF 1



CONSULTANT: TATA CONSULTING ENGINEERS LIMITED				
TECHNOLOGY PROVIDER: PREMIER TECH AQUA SYSTEMS INDIA PVT. LTD				
CUSTOMER: RAIPUR SMART CITY LIMITED, RAIPUR				
EPC CONTRACTOR: BHARAT HEAVY ELECTRICALS LTD. PE&SD, HYDERABAD				
PROJECT: 3.0 MLD STP AT RAIPUR		NAME DRN.: DSK	SIGN.	DATE 11.07.19
		CHD.: AKS		N.A.
		APPD.: MSSN		11.07.19
DEPT. PE&SD CODE 450	UNTOL. DIMS. GR. C/M/F	SCALE NTS	WEIGHT (KG) -N.A.-	REF. TO ASSY. DRG. -N.A.-
ITEM NO. -N.A.-		NO.OF ITEMS -N.A.-		
TITLE PIPING & INSTRUMENTATION DIAGRAM 3 MLD STP AT RAIPUR			BHEL DRAWING NO. PY-DP-1-M123-1040-01 REV. 01	
Size		SHT. No 1		NO. OF SHT. 1

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			Annexure-2	
			Rev. No.	00

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Refer to record of revisions	Girish Prasad Palo	Siva Prasad Babu	Siva Prasad Babu	06.05.2019

CUSTOMER:RAIPUR FOR RAIPUR SMART CITY LIMITED
PROJECT: 3.0 MLD STP AT BUDHATALAB
CONSULTANT: TATA CONSULTING ENGINEERS LIMITED

DATA SHEET FOR CENTRIFUGE FEED PUMP			
Sl.no.	Description	BHEL Requirement	BIDDER'S DETAILS
GENERAL DATA			
1	Service	Transferring ewage Sludge from Sludge Sump to Centrifuge	
2	Number of Pumps	2 Nos.[1W+1S]	
3	Location	Outdoor	
4	Duty	Continuous	
5	Drives	Motor	
6	Pumping fluid	Biological Sludge of 0.8 – 1% Solids Consistency	
7	Fluid temp Deg C/Sludge Size/Specific Gravity	Min 20 Deg.C/40 mm/1.05	
PUMP PERFORMANCE & OTHER DETAILS			
8	Pump Type	Positive displacement type Screw Pump (Horizontal)	
9	Design Standard of pump	To be mentioned by Bidder	
10	Rated Pump Flow	9.6 m3/hr	
	Rated Differential Head (mlc)	15 mlc	
12	Pump Model No.	To be mentioned by Bidder	
13	No. of Stages of pump	To be mentioned by Bidder	
14	Parallel operation	No	
15	Rated Speed of Pump (rpm)	Not more than 1500 rpm.	
16	Rated speed of Motor (rpm)	Not more than 1500 rpm.	
17	Pump Efficiency in %	To be mentioned by Bidder	
18	Available Pressure at centre line of Suction nozzle of Pump mlc	Min. 1.0 kg/cm2	
PUMP CONSTRUCTION FEATURES			
29	Material of Construction*: Pump housing: SS : CI IS 210 Gr. FG 260 Rotor: SS AISI 316 (hard chrome Plated) Shaft: SS : SS AISI 410 (hard chrome Plated) Stator: Nitrite Black Base plate: MS Fabricated Mechanical Seal: Silicon Carbide, Seal faces: The Primary (Inboard) seal should be of Silicon Carbide or Tungsten Carbide faces. The Secondary (Outboard) seal should be of Carbon v/s Cast Chrome Molybdenum Steel or Silicon Carbide or Tungsten Carbide – i.e., Thermally Unstable materials like Alumina/ Aluminum Oxide shall not be allowed. Motor: Aluminum Die Cast Rotors but Dual Cage Copper Bar shall be preferred. Other Components as per Manufacturer standard. * In case bidder can't meet above mentioned material, Bidder can offer Equivalent/Superior material suitable to the requirement.	To be Confirmed by Bidder	
30	Sealing arrangement	Mechanical Seal as per Manufacturer's Standard	
31	Type of bearings for pump	Antifriction	
32	Bearings lubrication	Pump bearings shall be designed with a minimum life of 40,000 hours and shall be designed for loading 20% in excess of calculated maximum loading. The bearings shall be grease lubricated for life and shall be maintenance free.	
33	Coupling used between Pump and Motor	As per Cl. No. 5.3.0 of Doc. No. PY51588	

CUSTOMER:RAIPUR FOR RAIPUR SMART CITY LIMITED
PROJECT: 3.0 MLD STP AT BUDHATALAB
CONSULTANT: TATA CONSULTING ENGINEERS LIMITED

Sl.no.	Description	BHEL Requirement	BIDDER'S DETAILS
PERFORMANCE TEST STANDARD FOR PUMPS			
34	Performance test standard	To be mentioned by Bidder	
35	Maximum Allowed Working Pressure (MAWP) in Kg/cm ² g	To be mentioned by Bidder	
36	Hydraulic test pressure of casing Kg/cm ² (g)	Hydraulic test pressure of casing shall be 1.5 times the MAWP. Test duration shall be minimum 30 min.	
37	Noise level for Pump	Max. 85 DbA @ 1.86 m from pump drive	
38	Vibration for Pump	All rotating equipment without reciprocating parts of motor rating ≤ 15 kW : 1.12 mm/sec All rotating equipment without reciprocating parts of motor rating > 15 kW & ≤ 75 kW: 1.8 mm/sec All rotating equipment without reciprocating parts of motor rating >75 kW : 2.8 mm/sec	
39	Pump Instruments	As per Manufacturer recommendation duly taking care of Specification requirement.	
MOTOR DETAILS			
61	Drive	Motor	
62	BKW at the rated point		
63	BKW at end of curve		
64	Selected drive rating in kW: The power rating of the pump motor shall be higher of following: (a) 115 % of power required by the pump at the duty point (b) 110 % of maximum power required by the pump from zero discharge to the runout point. (c) Power requirement at 110% safety valve overpressure.	Bidder to mention motor kW rating for the motor duly taking care of the requirements.	
65	Design Standard of Motor	IS 325/IEC60034	
66	Energy Efficient Class	IE3 as per IS 12615	
67	Manufacturer	As per Approved Sub Vendor List	
68	Ambient Temperature	50 Deg C All motors shall be designed to operate in humid atmosphere with a maximum ambient temperature of 50 Deg C.	
69	Area classification for motor	Safe Area	
70	Rated Voltage & Frequency	415 V & 50 Hz	
71	Permissible variations in Voltage/Frequency/Combined	(+/-)/10%/(+/-)/5%/(+/-)/10%	
72	No of poles / synchronous speed	Based on Pump Speed	
73	Method of Starting	Motor shall be capable of starting with DOL	
74	Method of cooling	To be Confirmed by Bidder	
75	Class of Insulation & Temp. rise	Class F with Temperature rise ltd. as per cl 5.2	
76	Degree of protection	As per Manufacturer Standard, Min. IP 55	
77	TB Short time-Current & Short time-Time	50 kA , 0.25 Sec	
78	Cable, Cable glands & Lugs	Cable details shall be furnished during DDE. Accordingly suitable double compression Nickel plated brass cable glands with back nut and PVC shroud and Tinned copper lugs to be provided by the bidder.	
79	No. of Starts	Motors shall be capable of three equally spread starts per hour under normal condition or two starts in quick succession from cold	
80	Bearing RTDs, Winding RTDs & TGs	As per Manufacturer Recommendation duly taking care of Specification requirement.	

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			Rev. No.	00

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Revisions:	Prepared by :	Checked by :	Approved by :	Date :
Refer to record of revisions	Girish Prasad Palo	Siva Prasad Babu	Siva Prasad Babu	06.05.2019

		BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032					
		PROJECT ENGINEERING & SYSTEMS DIVISION					
		Price format (R00) for Centrifuge Feed Pump with Drive Assembly PROJECT : 3.0 MLD STP AT BUDHATALAB CUSTOMER: RAIPUR FOR RAIPUR SMART CITY LIMITED					
SL NO	ITEM DESCRIPTION	QTY	UNIT	UNIT RATE (RS.)	TOTAL (RS.)	Weightage w.r.t Overall Price (In %)	
	Bidder's Name : <Bidder to indicate> Bidder's Offer No. & Dt. : <Bidder to indicate> Bidder's Ref No. & Dt. :<Bidder to indicate> BHEL Eng. No. & date :<Bidder to indicate>						
1	MAIN OFFER						
A	Centrifuge Feed Pump with Drive Assembly						
A.1.	MATERIAL SUPPLY						
	Positive displacement type Screw Pump(Horizontal) with Drive Assembly (weather proof) with required accessories, commissioning spares, Special tools & tackles inline with requirments mentioned in specification	2	Set			90	
A.2	O&M Spares						
i)	Mechanical seal	2	Set			5	
ii)	O-rings & gaskets	2	Set				
iii)	Bearing	2	Set				
A.3	Supervison charges for erection & commissioning at site						
a	Travel expenses from vendor works to site and back per visit /person	1	Visit			5	
b	Per day charges per person for supervision of erection & commissioning at site including boarding, lodging, lcoal transportation etc., except for travel expenses as above.	2	Days				
2	OPTIONAL ITEM						
A.1	10 Years Recommended Spares						
	Recommended spares list for 10 Years normal operation along with unit price breakup for Pump, Drive & other accessories.(List with price break up to be enclosed) (1 set stands for quantity required for the replacement of one pump, drive (or) accessories).	As per List	Set				
	TOTAL						
Notes:							
1) Bidder to quote strictly as per BHEL's NIT requirements.							
2) Bidder to note that this is a LUMP SUM Turn-Key Order. However (a) Changes to the tender specification during execution of the project for successful operation of the system need to be carried out by bidder and commercial implications if any will be settled suitably. (b) Unit rates quoted by bidder shall be applicable for any changes in BOQ during detailed engineering stage.							
3)Main offer consists of those items which will be part of main order after successful bidder is identified. Optional Items consists of those items which need to be quoted by bidder but may or may not be ordered by BHEL. Bidders are instructed to provide the pricing details listed under Main offer and Optional items as per the prescribed format.							
4) Prices quoted by bidders for items under main offer : Sl. No.1(A.1+A.2+A.3) will be considered for evaluation of lowest bidder. For the purpose of tender (L1 bidder evaluation). For Supervision of E&C, total no of 2 Man days to be covered in 1 Visit have been considered. However, either or both of the number of man days or no of visits may change on either side based on the actual site requirement. However, BHEL reserves the right (a) To include any of the optional items in scope of supply (as per customer contract requirements) and accordingly consider the same in evaluation. Any such scope increase and change in evalution will be intimated to vendor during technical evaluation(before price bid opening). (b) To place PO for any of the Optional items with in the contract period. Hence bidders need to mandatorily quote reasonable prices for all optional items considering such requirement and keep the validity of the prices till the end of contract period.							

		BHARAT HEAVY ELECTRICALS LIMITED R.C.PURAM, HYDERABAD-502032				
PROJECT ENGINEERING & SYSTEMS DIVISION						
Price format (R00) for Centrifuge Feed Pump with Drive Assembly PROJECT : 3.0 MLD STP AT BUDHATALAB CUSTOMER: RAIPUR FOR RAIPUR SMART CITY LIMITED						
SL NO	ITEM DESCRIPTION	QTY	UNIT	UNIT RATE (RS.)	TOTAL (RS.)	Weightage w.r.t Overall Price (In %)
Bidder's Name : <Bidder to indicate> Bidder's Offer No. & Dt. : <Bidder to indicate> Bidder's Ref No. & Dt. : <Bidder to indicate> BHEL Enq. No. & date : <Bidder to indicate>						
5.a) For all items including Optional items, prices to be furnished in this prescribed price bid format only for each individual item. The price to be quoted against sl no A.1, A.2, A.3 shall be Weightage w.r.t Overall Price as mentioned above. It may be noted that, No combined prices, common prices or any other format will be accepted and such bids may be liable for rejection. 5.b) Bidder must not change the indicated item description, quantity & units in the price bid format. Bidder should only fill the unit rates & total price. 5.c) Bidder to quote for all the items as per price bid format. Incomplete/partial offer may be liable for rejection.						
6) Bidder to quote the base rates only. All other commercial charges for packing, freight, transportation, insurance, taxes & duties etc., shall be indicated separately.						
7) Reference document: PY51588, R00 & annexures.						
8) Unpriced price bid format indicating as quoted against each applicable item shall be submitted duly signed & stamped along with technical offer by bidder as a token of concurrence that prices are submitted in this format only. The offer shall be liable for rejection in case if un-priced price bid format is not submitted or any modification is carried out in price bid format.						

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Refer to record of revisions	Girish Prasad Palo	Siva Prasad Babu	Siva Prasad Babu	06.05.2019

ANNEXURE-4

CHECKLIST FOR OFFER FOR POSITIVE DISPLACEMENT TYPE SCREW PUMP WITH DRIVE ASSEMBLY

Description	Enclosed (Yes/No)
Bidder to confirm to the scope of supply as per BHEL specs Doc. No. PY 51588.	
Bidder to furnish duly filled Pump-Motor datasheet as per Annexure-2. <u>Datasheets in other formats are strictly not accepted. Bidder to furnish filled in the Datasheets as per BHEL tender enquiry only.</u>	
Bidder to ensure that Positive Displacement screw type pump is quoted in line with Cl. No. 5.0.0 of BHEL Spec (Doc. No. PY 51588.)	
Bidder to confirm that all the Suitable reducers/expanders & counter flanges along with gaskets & stud nuts at all the terminal point, shall be in their scope inline with P&ID (Annexure-1 of Doc. No. PY51588).	
Bidder to confirm that the Motor Efficiency class considered is IE3 as per IS 12615 as mentioned in Cl. No. 5.2.0 of Doc. No. PY51588.	
Bidder to furnish a list of commissioning spares (Refer Cl. No. 5 of Doc. No. PY51588).	
Bidder to furnish a list of special tools & tackles (Refer Cl. No. 5 of Doc. No. PY51588).	
Bidder to confirm that the O&M Spares as indicated in Sl. No. 5 of Doc. No. PY51588 is considered in Bidders scope of supply.	
Bidder to furnish reference list for the offered pump in line with Cl. No. 6.0.0 of Doc. No. PY51588.	
Bidder to furnish a list of 10 Years Recommended Spares (Refer Cl. No. 5 of Doc. No. PY51588).	
Bidder to furnish the filled in unpriced price bid format along with their offer as per Annexure-3 of Doc. No. PY51588.	
Bidder to quote individual price for each item mentioned in the seal priced bid as per price bid format (Annexure-03 of BHEL specs Doc. No. of Doc. No. PY51588). Bidder to confirm the same.	
Deviations to the BHEL tender specifications shall be clearly bought by bidder in a separate deviation list. Bidder to furnish deviation list, if any, as per Annexure-08 of BHEL specs Doc. No. PY51588	
All important documents such as unpriced price bid, reference list, pump performance curve, Pump & drive assembly GA drawings, CS drawings must necessarily to be furnished by bidder along with their offer.	
Bidder to raise Pre bid queries, if any, must be raised as per Attached format (Annexure-10) before submission of technical and commercial bid. Any deviation/queries raised during technical bid submission shall not be entertained.	

SIGNATURE:
NAME:
DESIGNATION:
COMPANY:
DATE:

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			Rev. No.	00

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VOLUME II: Part-4 TECHNICAL SPECIFICATIONS FOR MECHANICAL WORKS

1.4.6 Progressive Cavity Pumps

i).These pumps shall be used for handling thickened sludge transfer/feed applications.

ii).Pumps shall be of the type in which a pumping action is generated by a helical rotating eccentrically within a resilient stator in the form of a double internal helix. The eccentric motion of the rotor shall maintain a constant seal across the stator as it travels through the pumps to give a uniform positive displacement.

iii).Pumps shall be arranged generally with a single shaft seal at the suction end. Mechanical seals shall be used. If a flexible shaft is used to accommodate the eccentric motion, a corrosion resistant shroud shall be fitted to prevent fibre build-up on the shaft. Enlarges inspection access holes shall be fitted to the suction chambers of all pumps for periodic removal of accumulated debris.

iv).The shaft bearing shall be positively isolated from the fluid being pumped.

v).The rotor material shall be selected and abrasion resistance for the fluid being pumped, and for prolonged service life. Hard chrome of other approved coating shall be not less than 250 micron thickness and shall be diffused in to the base material. The rotor shall generally be single stage and shall incorporate not less than 360° of twist, but for high-end applications, it may be necessary to use more than a single stage. The stator shall be of a resilient material selected for chemical and abrasion resistance for the fluid being pumped.

vi).Pump speed shall suit the application, where variable delivery output is needed; the pump shall be provided with a variable speed drive. The size and speed range of the pump shall ensure that the highest expected duty point shall lie within the available speed range.

vii).Pumps shall normally be driven by a fixed-speed electric motor through reduction gearing and the combined drive shall be continuously rated. Pump and motor shall preferably be mounted in-line on a common base plate.

viii).Coupling guards shall be provided, which shall be rigid, securely fixed, and designed so that removal is not necessary during normal operation, routine maintenance and routine inspections. All motor enclosures shall be provided with ingress protection to IP55. Motor anti-condensation heaters shall be provided and shall be suitable for use on a 220V single phase, 50Hz supply.

ix).All bearing shall have a B10 design life not less than 40,000 running hours and shall be designed for loading 20% in excess of calculated maximum loading, pumps shall be fitted with individual dry-running protection to initiate pump trip. Dry-running protection by 'under-current' monitoring of 'pipeline-intrusive' device shall not be used.

Material of Construction.

Component	Material
Pump housing	CI IS 210 Gr. FG 260
Rotor	SS AISI 316 (hard chrome Plated)
Shaft	SS AISI 410 (hard chrome Plated)
Stator	Nitrite Black
Type of drive	V belt & pulleys
Base plate	MS Fabricated
Seal Type	Gland Packing (Asbestos free)

VOLUME II: Part-4 TECHNICAL SPECIFICATIONS FOR MECHANICAL WORKS

The blades shall be of MS and properly balanced so as to avoid noise and vibration. The blade and Blade carriers shall be securely fixed so that they do not loosen in operation. The means provided for securing the fan mounting or fan casing to the wall partition or window shall be such as to provide a secure fixing damage to the fan or wall.

Suitably designed guards shall be fitted to the inlet and the outlet side to prevent accidental contact. No flammable material shall be used in the construction of fan. moulded parts, if used, shall be such material as to withstand the maximum temperature attained in the adjacent component parts.

The fan shall have protective insulation or be capable of being earthed. A fan with protective insulation may be of all insulated construction or have either double insulation or reinforced insulation. Each fan should be provided with a 10 mm² mesh bird screen. The sheet used for cowl should be 14 G.

1.8.3 Air Conditioning Equipment

Wall mounted split type air conditioners of appropriate capacity shall be provided for the control room. Outdoor condensing unit shall be located on the roof of the building or grouted on the external side of the wall with suitable brackets.

1.8.4 Domestic Water Pump Sets

The pump shall be Centrifugal type, self priming and mono-block type, suitable for pumping the clear water and treated sewage water. All the necessary piping with union, bends and tees shall be provided. Suction and discharge isolation valves and non return valves on the discharge side shall be forged steel. Piping shall be as per IS:1239 heavy class.

1.8.5 Fire Extinguishers

i). Portable fire extinguishers are to be provided for all units as per the requirement of Tariff Advisory Committee (TAC) or meeting the requirement of local regulations whichever is more stringent.

ii). All the extinguishers shall be of TAC approved.

1.9 Inspection and Testing

i). Inspection of all the equipments shall be carried out by the manufacturer at their facility in the presence of purchaser or his representatives.

ii). Successful bidder has to intimate purchaser / his representative in writing (Inspection call), 7 working days before the scheduled date of inspection.

iii). All internal test reports (as per approved QAP/ contract Document) to be submitted along with the inspection call letter.

1.10 INDUCTION MOTOR

1.10.1 SCOPE

The specification covers the design, material, constructional features, manufacture, inspection and testing at the VENDOR's / his SUB-VENDOR'S works, delivery to site and performance testing of Low Voltage induction motors rated up to 1000V.

1.10.2 CODES AND STANDARDS

The design, material, construction, manufacture, inspection, testing and performance of induction motors shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. The equipment shall also conform to the applicable standards specified in data sheet latest revision as on the date of offer. Nothing in this specification shall be construed to relieve the VENDOR of this responsibility. In case of conflict between the standards and this specification, this specification shall govern.

1.10.3 DRIVEN EQUIPMENT

- a. When this specification forms part of the driven equipment specification, information not given in the Data Sheet will be governed by the driven equipment specification.
- b. Motors shall be capable of satisfactory operation for the application and duty as specified in the motor Data Sheet and as specified for the driven equipment.

1.10.4 PERFORMANCE AND CHARACTERISTICS

- a. Motors shall be capable of giving rated output without reduction in the expected life span when operated continuously under either of the following supply conditions as specified in data Sheet.
 - b. Supply Condition
 - i. Variation in supply voltage from rated voltage: +10%
 - ii. Variation in supply frequency from rated frequency: +5%
 - iii. Combined voltage and Frequency variation: +10%
 - c. Motors shall be suitable for the method of starting specified in the data Sheet.
 - d. The minimum permissible voltage shall be 85% of the rated voltage during motor starting.
 - i. Motors shall be capable of starting and accelerating the load with the applicable method of starting, without winding temperatures reaching injurious levels, when the supply voltage is in the range of 85% of the rated motor voltage to maximum permissible voltage specified in data Sheet.

- e. The locked rotor current of the motor shall not exceed 600% of full load current (subject to tolerances as per the applicable standard) unless otherwise specified. The locked rotor current of VFD controlled motor shall be within the limit of IS:12615 / IEC.
- f. Motors shall be capable of developing the rated full load torque even if the supply voltage drops to 70% of the rated voltage. The pull out torque of the motor shall be at least 205% of full load torque.
- g. Motors when started with the driven equipment coupled shall be capable of withstanding at least two successive starts from cold conditions & one start from hot condition without injurious heating of windings. The motors shall also be suitable for three equally spread starts per hour under the above referred supply conditions.
- h. Motors shall be of Energy Efficient type. Category of Energy efficiency shall be as mentioned in data sheet.

1.10.5 INSULATION

- a. The insulation shall be given tropical and fungicidal treatment for successful operation of the motor in hot, humid and tropical climate.
- b. Motors which are VFD controlled shall be inverter grade and shall be suitably derated to take care of reduced cooling at lower speeds.
- c. Insulation of VFD controlled Motors shall be designed to withstand a dv/dt of 0.1 micro sec rise from 10 % to 90 % of steady voltage and a maximum peak of 1600 volts as per NEMA standard MG1 Part 31.40.4.2 .
- d. The insulation shall be of double coat winding wires which having superior electric strength and thermal capability for VFD controlled motors.
- e. Winding shall be insulated as VPI (Vacuum Pressure Impregnation) of winding with suitable resin forces which eliminating voids for VFD controlled motors.

1.10.6 TEMPERATURE RISE

- a. The temperature rises shall not exceed the values given in IS 12802. Under extremes of supply condition (clause 4.1 above), the temperature rise shall not exceed the value indicated in IS by 10°C.
- b. For motors specified for outdoor installation heating due to direct exposure to solar radiation shall be considered.

1.10.7 CONSTRUCTIONAL FEATURES

- a. All windings shall be of Copper. The winding insulation shall be Non-hygroscopic, oil resistant and, flame resistant.

b. Motors weighing more than 25 kg. shall be provided with eyebolts, lugs or other means to facilitate safe lifting.

c. Noise level and vibration limit should not exceed as specified in relevant IS / IEC.

d. Submersed Motor (wherever applicable) shall have following specific constructional features:

i. Motor shall be Air Filled yet capable of Water immersion up to 20mwc for S1 duty. Motors with Oil or Water filled windings shall not be allowed. Motor's Rotor shall be of dual caged copper bar brazed type to ensure;

- Long Corrosion free Service life (in presence of high moisture inevitable in submerged motors, Aluminum corrodes much faster than Copper),
- Ease of Onsite Repairing &
- Beneficial Fly Wheel type Inertial effect (as compared to aluminum rotor, copper rotor is heavy) which reduces detrimental effects of water hammer
- Better Motor Efficiency & Cooler Operating Temperature.
- Motors rated $\leq 110\text{kW}$ may be supplied with Aluminum Die Cast Rotors but Dual Cage Copper Bar shall be preferred.
- The Motor Rating should be higher of the two criteria i.e., 10% over Maximum pump shaft input at any point of the curve &/or 20% over pump shaft input @ duty point

ii. Motor Cooling:

- To restrict the Dead Water Level (in case of Vertical Installation) in the Sump to 1m, Medium & Large sized pumps ($\geq 55\text{kW}$) should have a Cooling Jacket – i.e. motor cooling is accomplished by circulation of pumped water between the motor casing & the jacket shell.
- In case the pumps are to be installed horizontally, the motor can be cooled just by water immersion i.e. no jacketing is required.
- This jacket shell is fed by cold water from the pump casing & discharges its heated water back into the sump (in case of Wet Installation) or Pump casing (in case of Dry Installation) by integrally cast ducts. There should not be any pipes, hoses, etc for this circulation.
- Alternatively Close Circuit cooling technology (using Glycol, etc) may also be offered.

iii. Motor Protection:

- Thermal Overload Protectors (Bi Metallic Over Load Relays) should be embedded in each phase of the stator winding to detect overheating & trip the motor from the control panel in the event of the temperature exceeding the safe operating limit (above B temperature class).
- To detect primary Mechanical Seal's Leakage a Moisture & Winding Sensor shall be provided in intermediately Oil Chamber (& not in the Motor casing or

elsewhere) – this shall detect water mixing in oil by mode of increased leakage current from the moisture sensor.

iv. Motors Cables:

- A watertight Cable Junction Box sealed from the motor shall be provided for the motor power and signalling cables.
- The cable shall be brought directly out of the submerged motor without joints, and shall be of sufficient length, minimum 10 m to be terminated in an IP 67 junction box (in the scope of electrical contractor) outside adjacent to the wet well & above the HFL. They shall be sized in accordance with the electricity utility regulations and BS 7671.
- It should have Power as well as Control Cables of Dual Sheathed EPRS / PVC Armoured type with Copper Core of required size. However the Cross Section of the cable shall be ample enough to ensure a Voltage Drop of not more than 2% at actual running conditions.

v. Stuffing Box / Oil Chamber:

- The pressurized entry of water into the motor (from the pump's volute casing) should be prevented by two separate mechanical seals mounted in a Tandem mode within an oil chamber.
- The Primary (Inboard) seal should be of Silicon Carbide or Tungsten Carbide faces to withstand erosive wear due to any silt particles. The Secondary (Outboard) seal should be of Carbon v/s Cast Chrome Molybdenum Steel or Silicon Carbide or Tungsten Carbide – i.e., Thermally Unstable materials like Alumina/ Aluminum Oxide shall not be allowed.

1.10.8 BEARINGS

- a. Unless otherwise specified in data sheet, motor bearings shall not be subjected to any external thrust load.
- b. Unless otherwise specified, motor bearings shall have an estimated life of at least 70,000 hrs.
- c. The bearings shall permit running of the motor in either direction of rotation.
- d. When forced oil lubrication or water cooling is required, prior approval from the purchaser shall be obtained.
- e. It shall be possible to lubricate the bearings without dismantling any part of the motor.
- f. VFD controlled Motors shall have their bearings insulated to prevent motor shaft currents from entering the bearing race.

- g. The bearings should be Permanently Greased with Premium Quality, High Temperature, Long Life Grease thereby obviating the need of re-lubrication for up to L10 life of the bearings.

1.10.9 TERMINAL BOX

- a. Terminal boxes shall have a degree of protection of atleast IP 55 for out door applicable.
- b. Unless otherwise approved, the terminal box shall be capable of being turned through 360o in steps of 90o.
- c. Terminals shall be of stud type & the terminal box shall be complete with necessary lugs, nuts, washers.
- d. When single core cables are to be used the gland plates shall be of non magnetic material.
- e. Sizes of terminal boxes and lugs shall be as given in Table-I, unless specified otherwise in data sheet.

TABLE-I

415 V motors - sizes of cables, studs, terminal lugs & terminal box (to be provided on motors by vendor)

Sr. No.	Motor (kW)	Rating	1100V AI Conductor, armoured PVC/XLPE Cable Cores x mm2
1.	Upto 3		3x4
2.	3.1 - 7.5		3x6
3.	7.6 – 15		3x16
4.	16 – 25		3x35
5.	26 – 40		3x70
6.	41 – 55		3x120
7.	56 – 70		3x185
8.	71 – 85		3x240
9.	86 – 110		3x400
10.	111 – 200		3Rx1Cx500

1.10.10 PAINT AND FINISH

- a. All motor parts exposed directly to atmosphere shall be finished and painted to produce a neat and durable surface which would prevent rusting and corrosion. The

equipment shall be thoroughly degreased, all rust, sharp edges and scale removed and treated with one coat of primer and finished with two coats of grey enamel paint.

1.10.11 HEATING DURING IDLE PERIODS

a. Motors rated above 30 kW shall have space heaters suitable for 240V, single phase, 50 Hz, AC supply. Space heaters shall have adequate capacity to maintain motor internal temperature above dew point to prevent moisture condensation during idle period. The space heaters shall be placed in easily accessible positions in the lowest part of the motor frame.

1.10.12 ACCESSORIES

a. Two independent earthing points shall be provided on opposite sides of the motor, for bolted connection of the PURCHASER'S earthing conductors as specified in data sheet. These earthing points shall be in addition to earthing stud provided in the terminal box.

b. Except when otherwise specified, the motors shall be provided with a bare shaft extension having a key slot and a key at the driving end.

1.10.13 TESTS

a. Motor shall be subjected to all the routine tests as per applicable standard in the presence of the PURCHASER'S representative. Copies of test certificates of type and routine tests shall be furnished as specified in the distribution schedule, for the PURCHASER'S approval. The VENDOR shall ensure to use calibrated test equipment/instruments having valid calibration test certificates from standard laboratories traceable to national/international standards.

b. If type tests have not been carried out on similar Motors, or if the type test reports submitted are not found in order, then VENDOR shall carry out these tests without any extra cost to the Purchaser.

1.11 Pressure Sand Filter and Activated Carbon Filter

Filters shall be of vertical type. Vessels shall be designed as per IS:2825 Class II, the filter Shell and dish End shall comprise a mild steel IS:2062 Gr.B electrically welded shell complete with nozzles and nozzle plates internal distribution and draw-off through, faced pads for inlet, outlet, wash-in, drain, adequate sized access manholes, filter supporting feet, necessary filtering media and sundry accessories. Shell shall be treated internally with an approved anti-corrosion coating (Polyurethane), and externally with primer and under coat prior to application of two coats of finishing paint of food grade quality of approved colour with Total DFT 250 microns. Corrosion allowance of 3 mm shall be considered thickness of the shell and Dish End and 1mm thinning allowance for Dish Ends. Full GA and design details shall be submitted at time of tendering for acceptance.

Filters shall be equipped with automatic and bulk air release valves, back-wash water sight glasses, inlet and outlet pressure gauges, flow meters and associated panels,

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v). Impellers shall be provided with means to prevent abrasive matter reaching the glands and with fully shrouded impellers, to prevent the trapping of matter between the impeller vanes and the casing.

vi). The speed of any pump shall not exceed 1500 rpm.

vii). Glands may be fitted with suitable mechanical seals or conventional soft packing. The gland arrangement shall be designed for easy adjustment or removal of the seal or packing material. Shafts shall be sleeved around the area of the gland when soft pack glands are used.

viii). Flushing facilities shall be provided for mechanical seals or packed glands where pump fluid may be contaminated with abrasive material. Where soft packed glands are used, means shall be provided for collection of the gland leakage water, which shall be piped into the drainage system through adequately sized ports.

ix). Lubrication arrangements shall be so designed that there is no contamination of the pumped fluid.

x). The pumps and associated pipe work shall be wherever possible, arranged so that air can be completely expelled during priming. Where this is not possible, facilities shall be provided for the removal of the trapped air. Adequate facilities shall be provided for drainage of the pumps for inspection purposes.

xi). Tapping shall be provided at both the suction and discharge flanges for pressure gauge equipment.

1.4.5 Pump performance Guarantees

i). The pump performance guarantee shall relate to the flow rate, the total head and the efficiency of the pump when tested at the manufacturer's work and shall obtain approval of engineer.

ii). The pump shall operate at its design point within acceptance tolerances for flow rate and total head laid down in BS EN ISO 9906:2000.

iii). Each pump shall be tested at the manufacturer's work in accordance with BS EN ISO 9906:2000 or other relevant standards in conjunction with one of the contract motors.

iv). This test shall be carried out on at least one pump set using the flexible coupling and contract drive shaft arrangement to establish that the drive arrangement with supports and couplings operates satisfactorily under all operating conditions.

v). Where similar drive shaft arrangement have been installed by the contractor and have been proven satisfactory in service this requirement may be withdrawn subject to the approval of the engineer.

vi). A test shall be carried out of the performance from closed valve to the maximum quantity that can be delivered under abnormally low discharge heads.

vii).Sufficient reading shall be taken at each test to produce accurate curves of the heads, flow, pump speed and power required at pump coupling throughout the operating range of the pump.

viii).Vibration and noise dB(A) levels shall be measured and shown to be acceptable and shall have Engineer's approval. The contractor shall have engineer approval and provide acceptable test certificates, showing the NPSH requirement for the pump is at least 2m less than the NPSH available under all working conditions.

ix).In the absence of the approved test certificates the supplier shall carry out a test on one pump of each type to verify the NPSH requirement based upon the 3% output drop criterion and shall taken approval of Engineer.

x).The certificates shall be submitted to the Engineer immediately following each of the tests mentioned above. Performance curves shall also be incorporated in the operation and maintenance manual.

Single Pump Operation

- i).Head / Quantity Curve
- ii).Motor kW input/Quantity curve
- iii).Overall efficiency/quantity curve
- iv).NPSH required/quantity curve
- v).Vibration and Noise dB(A) levels.

Parallel Pump Operation

- i).Head / Quantity Curve
- ii).Motor kW input/Quantity curve
- iii).Overall efficiency/quantity curve
- iv).NPSH required/quantity curve
- v).Vibration and Noise dB(A) levels.

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and approved by an independent testing authority not more than one month prior to the tests in which they are used. Calibration certificates with expire date and name of authorization agency for instruments used for such tests shall be produced for the approval of the Employer's Representative and if necessary, instruments shall be recalibrated before the commencement of the tests.

No material shall be delivered to the Site without inspection having been carried out or waived in writing by the Employer's Representative.

If during or after testing, any item of plant fails to achieve its intended duty or otherwise proves defective, it shall be modified or altered as necessary and retested and re-inspected as required by the Employer's Representative.

4.1.4 Tests at Manufacturer's Premises – Mechanical Equipment

4.1.4.1 Sewage / Sludge Pumps

All pumps shall be assembled completely in the shop to ensure correct fitting of all parts and shall be match-marked before shipment.

- (a) All pumps shall undergo witness performance tests at the pump manufacturer's Works. Testing shall be undertaken with the respective motors for all the pumps being supplied under the Contract.
- (b) All tests such as Q/H curve, efficiency of pumps, power consumption, vibration and noise level shall be conducted, and NPSH tests one for each pumping station shall be undertaken to verify that the pumps meet the specified criteria. The pumps shall be run at constant flow capacity and speed.
- (c) Pump casings shall be subject to hydrostatic pressure testing as an assembly at 150% of the pump shut-off head or 200% of the pump rated head whichever is higher. The hydrostatic pressure shall be held for not less than 30 minutes after all leaks have been stopped between attachments.
- (d) Impeller and pump rotating assembly shall be dynamically balanced as per ISO 1940 / Gr. 6.3 / VDI 2060.
- (e) Standard running test shall be conducted as per BS 5316 Part 2 Class B / ISO 3555 at the rated speed at manufacturer's works to measure the capacity, total head, efficiency and power. These tests shall form the basis for pump acceptance except for vibration and noise. The pump shall be tested over a range comprising shut off

head to maximum flow. Minimum five readings approximately equidistant shall be taken for plotting the performance curve.

- (f) The following formula shall be taken for computing the power input to the pump:

$$\text{Power input to the Pump in kW: } \frac{Q \times H \times 1.02}{367.2 \times \eta_p}$$

Where, Q = Discharge in cum/hr

H = Total head in mwc

η_p = Efficiency of pump

- (h) If the vibration, noise level readings taken during performance test show higher than that permitted, vendor shall guarantee to show that the values shall be maintained at site after erection. Any cost of rectification needed on this count shall be borne by the Contractor.

4.1.4.2 Motors

- (a) Routine Tests

All routine tests shall be carried out on all motors as per the latest edition of IS 325.

- (b) Acceptance Tests

Full load test to determine efficiency, power factor and slip shall be conducted on all the motors.

- (c) Type tests

The following type tests shall be carried out on one motor of each rating above 18.5 kW.

- (1) Isolation resistance test
- (2) Temperature rise test
- (3) Momentary overload test
- (4) Vibration measurement test
- (5) Noise level test
- (6) Over speed /over load test
- (7) Starting current, starting torque, and pull out torque at reduced voltage

4.1.4.3 Valves

- (a) During testing there shall be no visible evidence of structural damage to any of the valve component.

- (b) Motorized valves shall be tested with their actuators, with a differential head equivalent to their maximum working pressure, to prove that the actuators are

25 Centrifuge Feed Pumps

S. No.	Sub S. No.	Description	Units	Particulars
(a)	(i)	Make		
	(ii)	Type		
	(iii)	Model		
	(iv)	Quantity (W+S)		

S. No.	Sub S. No.	Description	Units	Particulars
	(v)	Capacity	l/s	
	(vi)	Head	mlc	
	(vii)	Efficiency	%	
	(viii)	Max. Solid size	mm	
	(ix)	Power absorbed	kW	
	(x)	Speed	rpm	
	(xi)	Motor rating	kW	
	(xii)	Motor Make		
(b)		Material of construction		
	(i)	Casing		
	(ii)	Rotor		
	(iii)	Stator		
	(iv)	Line shaft		
	(v)	Sealing		
	(vi)	Base Plate		
(c)		Construction Features		
	(i)	Flange drilling standard		
	(ii)	Suction diameter	mm	
	(iii)	Discharge diameter	mm	
	(iv)	Coupling type/make		

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The Contractor shall have a separate cleaning gang to clean all equipment under erection and as well as the work area and the project site at regular intervals to the satisfaction of the employer. In case the cleaning is not up to the employer's satisfaction, he will have the right to carry out the cleaning operations and any expenditure incurred by the employer in this regard will be to the Contractor's account.

Erectors

The Contractor's employees shall include skilled erection staff in sufficient number, who shall arrive on the site on or before the respective dates set out in the approved work programmed and prior to delivery of any item of Plant to the Site. The Employer's Representative will not entertain any claim by the Contractor in respect of delayed erection due to a delay in the delivery of any items of Plant to the site.

Contractor's Equipment, materials and appurtenances

The Contractor shall have available on the Site sufficient suitable equipment and machinery, as well as all other materials and appurtenances required by him, of ample capacity to ensure the proper erection of Plant and to handle any emergencies such as may normally be expected in work of this character.

The Contractor shall be responsible if any installation materials are lost or damaged during installation. All damages and thefts of equipment/component parts, after takeover by the Contractor, till the installation is taken over by Employer shall be made good by the Contractor to the satisfaction of Employer's Representative.

Workmanship

Plant shall be erected in a neat and workmanlike manner on the foundation and at the locations and elevations shown on the approved drawings and other Employer's Engineering documents. Unless otherwise directed by the Employer's Representative the Contractor shall adhere strictly to the aforesaid drawings and no departures there from will be permitted.

All plant shall be correctly aligned, leveled and adjusted for satisfactory operation and shall be installed so that the proper and satisfactory connection can be made readily between the various units and pipe work and equipment installed under the Contract. The mounting arrangements for pump-sets and blowers shall be such that the alignment offset between motors and the driven equipment shall be well within 0.1 mm.

Building-in

Erection of Plant shall be phased in such a manner so as not to obstruct the work being done by other contractors. Before commencing any erection work, the Contractor shall check the dimensions of structures where the various items of plant are to be installed, and shall bring any deviations from the required positions, lined or dimensions to the notice of the

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replacement for 15 year minimum and new to repair of not less than five years. Design features shall include the protection of equipments against damages caused by vermin, dirt, dust and dampness and to reduce the risk of fire. Equipment shall operate without undue vibration.

The noise level produced by any equipment like pump sets, compressor sets, blowers etc, shall not exceed 85 dB(A) measured at a distance of 1.86 m from outer surface of source. At the time of operation, the mechanical vibration shall not exceed the limit given in the Table 2-1, at recommended points of the measurement as per ISO 10816:1995.

During the commissioning of the plant/equipments if noise level/vibrations found beyond the permissible limit, contractor to rectify/replace the particular equipment at no extra cost with in mutually agreed time limit. During the O&M period (O&M is done by contractor) if noise/vibration of equipment found beyond the permissible limit, rectify/replace of the particular equipment shall be responsibility of contractor.

Table 2-1: Permissible Equipment Velocity of vibration (in mm/sec)

Sr. No.	Equipment	Permissible Velocity of Vibration (in mm/sec)
1	All rotating equipment without reciprocating parts of motor rating ≤ 15 kW	1.12
2	All rotating equipment without reciprocating parts of motor rating > 15 kW & ≤ 75 kW	1.8
3	All rotating equipment without reciprocating parts of motor rating > 75 kW	2.8

Parts shall be design to withstand the maximum stresses under the most sever conditions of normal service. All rotating elements shall be dynamically and statically balanced.

1.2.4 Lubrications

The equipment shall be lubricated by long life lubricants such that working life is not less than 3000 operation hours or as per recommendation of the equipment manufacturer. A complete schedule of recommended oils and other lubricants shall be furnished by the bidder. The number of different types of lubricants should be kept to minimum. The schedule and the name of the supplier of the lubricant shall be submitted to the owner's representative for approval.

Lubricants shall be oil and grease. The contractor shall indicate indigenously available equivalent lubricants with complete specifications.

Where the lubricant is grease, preference shall be given to a pressure system which does not require frequent adjustment or recharging. Preferably, life lubricated grease

VOLUME III C PART 4: TECHNICAL SPECIFICATIONS FOR
INSTRUMENTATION, CONTROL AND AUTOMATION

1.15.5. Return Activated Sludge (RAS) Pumps

- a) Under normal operation, the RAS pumps shall run continuously in remote auto mode.
- b) In auto mode, two operator-selectable sub-modes shall be provided – FLOW and RATIO.
- c) In either mode, the total RAS flow shall be maintained within operator-specified overriding minimum and maximum values.
- d) The RAS pumps shall be manually operable at a local control panel located adjacent to the equipment, or automatically operated from the STP SCADA HMI.

1.15.6. Surplus/Waste Activated Sludge (SAS/WAS) Valve

- a) Under normal operation, the SAS valve shall be controlled by the PLC in remote auto mode. In remote auto mode, three operator-selectable sub-modes shall be provided for control of the SAS valve – CONTINUOUS, TIMED, and TOTALIZED.
- b) In the CONTINUOUS mode, the valve shall be modulated to maintain an operator-specified flow rate set-point.
- c) In the TIMED mode, the SAS valve shall be opened and closed according to an operator-specified timer program. When the valve is not closed, the valve and flow rate shall be controlled as in the CONTINUOUS mode.
- d) In the TOTALIZED mode, the SAS valve shall be opened at an operator-specified start time once per day, and the valve and flow rate shall be controlled as in the CONTINUOUS mode. The valve shall be closed when an operator-specified total SAS volume has been pumped.
- e) The SAS valve shall be manually operable at an actuator interface control panel, or at the STP SCADA HMI.

1.15.7. Disinfection

- a) Chlorine Disinfection
 - i. Under normal operation, the chlorinators shall be controlled in remote auto mode. In remote auto mode, two operator-selectable sub-modes shall be provided – DOSE and ORP.
 - ii. In DOSE mode, the chlorine gas flow control valves of the chlorinators shall be automatically modulated to maintain an operator-specified chlorine dose set point. The operator-specified set point shall be multiplied by the plant influent flow and divided by the number of chlorinators in service to generate chlorine mass flow rate set point per chlorinator.
 - iii. In CASCADE mode, the ORP error (difference between an operator-specified ORP set point and measured ORP value) shall be used to generate a modulating signal. This modulating signal shall be used to automatically generate a variable chlorine dose set point. The chlorine gas flow control valves of the chlorinators shall be automatically modulated to maintain the automatically generated variable chlorine dose set point.

ESP-001- 2A Rev.00	 	BHARAT HEAVY ELECTRICALS LIMITED PROJECT ENGINEERING & SYSTEMS DIVISION RAMACHANDRAPURAM: HYDERABAD - 502 032	Std. / Doc. Number	
			Annexure-6	
			Rev. No.	00

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Revisions:	Prepared by :	Checked by :	Approved by :	Date :
Refer to record of revisions	Girish Prasad Palo	Siva Prasad Babu	Siva Prasad Babu	06.05.2019

TD-201 Rev No. 00 Form No.		PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD	ANNEXURE - 6
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QAP GUIDELINES & FORMAT

(ANNEXURE - 6)

The QAP format and guidelines for filling up the format shall be used by vendor for preparation and submission of QAP after order placement.

Note :

1. Typical /Indicative /Standard QAP(s) for equipment /package attached is reference document and to use by successful bidder in future for preparation and submission of QAP for BHEL /CUSTOMER approval.
2. No deviation to reference document is acceptable.

Form No.	 HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD	ANNEXURE - 6 Rev No. 00 Page 2 of 3
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.	<u>GUIDELINES TO VENDORS FOR PREPARATION OF QUALITY ASSURANCE PLAN</u>		
	1. QAP shall be made in landscape mode on A4 size paper as per the format enclosed. Font size shall be minimum 10. 2. Each page of QAP shall contain the following information. a) Vendor's name & address. b) Customer: BHEL, Hyderabad. c) Project. d) BHEL Product Standard Number/revision number as referred in P.O. e) BHEL Purchase Order Number & Date. f) Product as per P.O. description. g) QAP Number (unique and shall not repeat)/revision number/date. h) Page number and number of pages 3. QAP shall contain four parts / stages as follows. a) Raw materials and bought out items. b) In process Control / Inspection. c) Final assembly, Inspection & Testing. d) Painting, preservation & packing. 4. Under 'Component', indicate name of the component (say casing, rotor, pressure gauge, etc). 5. Under 'Characteristics', indicate appropriately (say chemical analysis, mechanical properties, NDT (UT,DP etc.), hydrostatic test, calibration check etc.) 6. Under 'Class', indicate minor, major or critical depending on the importance of characteristic. 7. Under 'Type of check', indicate appropriately (say chemical, mechanical, UT, DP etc.) 8. Under 'Quantum of check', indicate appropriately (say 100%, 10%, sample, per melt, per heat, all pieces etc.) 9. Under 'Reference document' and 'Acceptance norms', appropriate National & International standards, BHEL standards, approved drawing references etc. should be indicated. It is not correct to mention as "Vendor's internal standards or Vendor's standard practice etc.". If vendors' internal standards are referred, same shall be in line with BHEL Spec. indicated in the P.O. These may require review & approval by our Engineering dept. 10. Under 'Format of record', indicate appropriately supplier's test certificate, calibration certificate, lab report, inspection report etc. 11. Please refer 'Agency' in QAP format. Under P: Perform, W: Witness, V: Verify Indicate against each characteristic 1: (BHEL CQS/Nominated inspection agency), OR 2: (Vendor / Sub vendor)		
Ref. Doc			

Form No.	 HYDERABAD	PRODUCT STANDARD PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD	ANNEXURE - 6 Rev No. 00 Page 3 of 3
COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.	Note: Performing agency is normally vendor or his sub vendor (Legend 2). Where witness points are indicated in specification, P.O., Drawing etc., for such operations, Under Witness (W) column use 1. Under 'Verify' column, use code1. 12. Under 'D' please put (☐ Tick) against each characteristic where vendor proposes to submit test certificate/report etc. OR as required as per BHEL Specification. 13. Vendor's signature & stamp should be available on each page of QAP. 14. Vendor should read the BHEL Product Standard thoroughly and QAP should be made only inline and relevant to the Specification & Approved Drawings. 15. The following operations/characteristics/check points may be included (AS APPROPRIATE) a) Visual check b) Dimensional check c) Mechanical and Chemical properties. d) Surface preparation before painting (by chemical cleaning, sand blasting, shot blasting etc. as the case may be.) e) Painting check for shade, Dry Film Thickness (DFT), Adhesion/ peel off test etc. f) Check for correctness for all components mounted as per General arrangement Drawing, Bill Of Materials (BOM), etc. for range, rating, make, color, size, location as per GA, quantity, label description including tag nos., annunciator facia, loose components, accessories, spares etc. g) Verification of test certificate for protection class for the enclosures. h) Mechanical functioning of switches. i) Continuity of earthing and provision of earth points. j) Colour coding of wiring, size, tightness & dressing of wiring. k) Review of test certificates of assembled items, raw materials, internal test reports etc. l) Witness of functional checks, which may include mechanical run & electrical run, H.V.test, IR measurement, Electrical and Mechanical tests etc. m) PQR, WPS, Welder Qualification Record, welding records (fit up, DP) etc. n) Material identification (for punch marks of serial numbers, Heat No, Melt No, Inspector's stamp etc.) o) Hydraulic Pressure Test, Pneumatic Pressure Test, Liquid Penetration Examination and other Non-Destructive Tests. p) Tests on Galvanised items (Visual, Hammer Test, Knife Test, Thickness, Pierce Test (Copper sulphate test), Hydrogen evaluation test, Stripping test (for Mass of Zinc coating) q) All tests as per BHEL Product Standard & approved drawings including Type tests and Routine tests on individual items and on System as a whole. r) Packing and Preservation. 16. QAP Format enclosed. 17. Typical Manufacturing QAP(s) is /are attached.		
Ref. Doc			

VENDOR'S NAME & ADDRESS:		MANUFACTURING QUALITY PLAN							QP. NO.:				
		CUSTOMER: BHEL, HYDERABAD – 32.				BHEL P.O.NO.:			REV NO:		DATE:		
		PROJECT: PRODUCT:				P.O.DATE: BHEL SPEC:			REV:		PAGE 1 OF 1		
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P W V			REMARKS
1.0	RAW MATERIALS & BOUGHT OUT ITEMS												
2.0	INPROCESS INSPECTION												
3.0	FINAL INSPECTION & TESTING												
4.0	PRESERVATION & PACKING												

VENDOR TO NOTE: THIS FORMAT IS IN MICROSOFT WORD. HEADER & FOOTER SHALL BE AVAILABLE IN EACH PAGE OF QP. QP SHALL BE IN LANDSCAPE & A4 SIZE ONLY. FONT SIZE SHALL BE MIN 10. VENDOR SHALL SIGN & STAMP IN EACH PAGE OF QP. LOI REF. & DATE ARE NOT ACCEPTABLE. P.O.NO. & DATE SHALL BE INDICATED. QP NO. SHOULD BE UNIQUE AND SHALL NOT REPEAT. ALL THE TESTS / CHECKS INDICATED IN THE BHEL SPEC. SHALL BE INDICATED IN THE QP.

LEGEND: P: PERFORM, W: WITNESS, V: VERIFICATION. INDICATE 1 FOR BHEL CQS (OR BHEL NOMINATED INSPECTION AGENCY) & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.	PREPARED BY	APPROVED BY	APPROVED BY
	VENDOR'S SIGNATURE & STAMP	BHEL QA SIGNATURE & STAMP	CUSTOMER'S SIGNATURE & STAMP

		TYPICAL MANUFACTURING QUALITY PLAN						MQP. NO.:					
		PROJECT ENGINEERING & SYSTEMS			PROJECT:			REV NO:		DATE:			
		DIVISION BHEL, RC PURAM, HYD-502032			PACKAGE: SCREW PUMPS BHEL TECH SPEC:			PAGE 1 OF 2					
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
1.0 RAW MATERIALS & BOUGHT OUT ITEMS													
1.1	Casing	Chemical & Mech. Properties	Major	Chemical & Mech. analysis	1 per heat/lot	Tech Spec/ Approved Datasheet/ Approved Drawing		MTC	√	2	2	1	
1.2	Screw, Drive shaft and Stator	Chemical & Mech. Properties	Major	Chemical & Mech. Analysis	1 per heat/lot			MTC	√	2	2	1	
1.3	Gear box, Mechanical seals and bearings, V belts and Pulleys	Make and model verification	Major	Visual and OEM certificate/ COC review	100%			OEM certificate or COC	√	2	2	1	
1.4	Gaskets, Flanges, and Fasteners	Chemical & Mech. Properties	Minor	OEM's certificate review	1 per heat/lot			OEM test certificates	√	2	2	1	
1.5	Safety valve or Pressure relief valve (as applicable)	Chemical & Mech. Properties, Hydro Test, Set Pressure Test	Major	OEM's certificate review	100%			OEM test certificates	√	2	2	1	
2.0 INPROCESS INSPECTION													
2.1	Screw and Drive shaft	NDE	Major	DPT and UT (if shaft > 50 mm diameter)	100%	Tech Spec/ Approved Datasheet/ Approved Drawing		NDE reports	√	2	2	1	
2.2	Casing	Surface finish & NDE	Major	Visual and DPT/MPI	100%			NDE reports	√	2	2	1	
2.3		Leakage	Critical	Hydro test	100%			Test reports	√	2	2	1	
2.4	Coupling	Unbalance	Major	Dynamic balancing	100%			Test reports	√	2	2	1	
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		TYPICAL MANUFACTURING QUALITY PLAN							MQP. NO.:				
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032			PROJECT: PACKAGE: SCREW PUMPS BHEL TECH SPEC:		REV NO:	DATE:					
										PAGE 2 OF 2			
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	

3.0	FINAL INSPECTION & TESTING											
3.1	Pump assembly with job motor	Overall Dimensions	Major	Measurem ent	100%	Tech Spec/ Approved Datasheet/ Approved Drawing	TC	√	2	1	--	Only 10% witness by BHEL / BHEL's TPIA, subjective to minimum 1 pump of each size & type.
3.2		Performance test	Critical	Testing	100%		TC	√	2	1	--	
3.3		NPSH (if applicable)	Critical	Testing	100%		TC	√	2	1	--	
3.4		Mechanical run test	Critical	Testing	100%		TC	√	2	1	--	
3.5		Strip Examination in case of abnormal noise and vibrations	Major	Dismantling	100%		IR	√	2	1	--	
3.6		Spares (if any)	Major	BOM check	100%		IR	√	2	1	--	
4.0	PRESERVATION & PACKING											
4.1	Pump and its components	Direction of rotation, Stamping and Painting	Major	Visual, Shade & DFT	Random	Tech Spec/ Approved Datasheet/ Approved Drawing	IR	√	2	1	--	# Seaworthy packing for export orders
4.2		Packing #	Major	Visual	100%		Packing List	√	2	2	--	

Notes:-

1. This MQP should be read along with specification ((Latest revisions to be considered as per PO), approved drawings & approved datasheet.
2. Specification/drawing/datasheet shall prevail over quality plan for contradiction if any.
3. Any project/customer specific requirements which shall be notified have to be fulfilled by the vendor at the time of execution of order.

Abbreviations:-

MTC	–	Material Test certificate	COC	–	Certificate of Compliance	DFT	–	Dry Film Thickness
TC	–	Test Certificate	NDE	–	Non Destructive Examination	IR	–	Inspection Report
DFT	–	Dry Film Thickness	IBR	–	Indian Boiler Regulations	IS	–	Indian Standards

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		TYPICAL MANUFACTURING QUALITY PLAN						MQP. NO.:					
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032			PROJECT: PACKAGE: MOTOR BHEL TECH SPEC:			REV NO:		DATE:			
								PAGE 1 OF 4					
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
1.0 RAW MATERIALS & BOUGHT OUT ITEMS													
1.1	<u>COPPER WIRE</u> Enameled Copper Wire	Overall diameter, elongation, Mandrel winding test, Peel test, springiness, Abrasion test, Cut through test, Heat shock test, Continuity test	Major	Measurem ent and mechanical & electrical testing	One sample per heat/lot	National & international standard (IS or IEC) / technical specification/ approved drawing/ datasheet		IR / supplier test certificate	√	2	2	1	
1.2	<u>STEEL SHAFT</u> Straightened Steel bar in black Finish	Dimensions, surface finish, chemical composition	Major	Visual, measurem ent and chemical testing	One sample per heat/lot			supplier test certificate	√	2	2	1	
1.3		NDT	Major	UT	100%			supplier test certificate	√	2	2	1	
1.4	<u>ALUMINIUM INGOTS</u>	Chemical properties	Major	Chemical testing	One sample per heat/lot			supplier test certificate	√	2	2	1	
2.0 INPROCESS INSPECTION													
2.1	ASSEMBLY	Completeness and correctness of assembly	Major	Visual verification	100%	MO and manufacturer's internal processes		Log book	--	2	2	--	

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		TYPICAL MANUFACTURING QUALITY PLAN						MQP. NO.:					
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032			PROJECT: PACKAGE: MOTOR BHEL TECH SPEC:			REV NO:		DATE:			
								PAGE 2 OF 4					
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
3.0	FINAL INSPECTION & TESTING												
3.1	ROUTINE TESTING	Measurement of winding resistance in cold condition	Major	Testing	100%	National & international standard (IS or IEC) / technical specification		TC	√	2	1	--	
3.2		SH heater resistance (if applicable)	Major	Testing	100%			TC	√	2	1	--	
3.3		Insulation resistance (before and after HV test)	Major	Testing	100%			TC	√	2	1	--	
3.4		High voltage test at 1.8 KV for 1 minute and space heater HV test	Major	Testing	100%			TC	√	2	1	--	
3.5		Direction of rotation	Major	Testing	100%			TC	√	2	1	--	
3.6		No load test (measurement of NL A, voltage, NL power and NL RPM)	Major	Testing	100%			TC	√	2	1	--	
3.7		Reduced run up voltage test at (rated volt√3)	Major	Testing	100%100%			TC	√	2	1	--	
3.8		Locked rotor test at full load current	Major	Testing	100%			TC	√	2	1	--	
3.9		Vibration measurement	Major	Testing	100%			TC	√	2	1	--	
3.10		Measurement of noise level	Major	Testing	100%			TC	√	2	1	--	
3.11		120% over speed test	Major	Testing	100%			TC	√	2	1	--	

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		TYPICAL MANUFACTURING QUALITY PLAN						MQP. NO.:					
								REV NO:		DATE:			
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032			PROJECT: PACKAGE: MOTOR BHEL TECH SPEC:			PAGE 3 OF 4					
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
3.12	TYPE TESTS	Measurement of winding resistance in cold condition	Major	Testing	One /rating	National & international standard (IS or IEC) / technical specification		TC	√	2	--	1	Verification of Identical Type test Report of same Rating.
3.13		Temp. rise test at full load (load point for 100%, 75% & 50% load (full load, ¾ and ½ load)	Major	Testing	One /rating			TC	√	2	--	1	
3.14		160% momentary overload test	Major	Testing	One /rating			TC	√	2	--	1	
3.15		Locked rotor amp and torque test	Major	Testing	One /rating			TC	√	2	--	1	
3.16		No load test	Major	Testing	One /rating			TC	√	2	--	1	
3.17		Reduced voltage running up test	Major	Testing	One /rating			TC	√	2	--	1	
3.18		Insulation resistance test (before and after HV test)	Major	Testing	One /rating			TC	√	2	--	1	
3.19		HV test – 1.8 KV for winding and 1.5 KV for space heater	Major	Testing	One /rating			TC	√	2	--	1	
3.20		Vibration test	Major	Testing	One /rating			TC	√	2	--	1	
3.21		120% over speed test	Major	Testing	One /rating			TC	√	2	--	1	
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								REV NO:		DATE:			
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032			PROJECT: PACKAGE: MOTOR BHEL TECH SPEC:			PAGE 4 OF 4					
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
									D	P	W	V	
4.0	PRESERVATION & PACKING												
		Painting*, (Shade, DFT,) Marking	Major	Visual, DFT	Random	Technical specification/ approved drawing/datasheet	TC	√	2	--	1		
		Packing*	Major	Visual	Random		Packing List	√	2	--	--		

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Abbreviations:-

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TC	–	Test Certificate	NDE	–	Non Destructive Examination	IR	–	Inspection Report
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ESP-001- 2A Rev.00	 	BHARAT HEAVY ELECTRICALS LIMITED PROJECT ENGINEERING & SYSTEMS DIVISION RAMACHANDRAPURAM: HYDERABAD - 502 032	Std. / Doc. Number	
			Annexure-7	
			Rev. No.	00

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Annexure-7

Revisions:	Prepared by :	Checked by :	Approved by :	Date :
Refer to record of revisions	Girish Prasad Palo	Siva Prasad Babu	Siva Prasad Babu	06.05.2019

53	CI Soil Pipes & Fittings as per IS : 3989/84	NECO, CENTRI
54	G.I. Pipes Class "C"	TATA, Zenith, Jindal, Suryaprakash
55	G.I. Fittings	Approved ISI Manufacturers
56	Gate Valve / Non Return Valve	Sant, Zoloto, Leader
57	S.W. Pipes	Rajura or other Approved ISI Manufacturers
58	Flush Valve	Jaguar , Ess Ess
59	Water Meter	Capstan or other Approved ISI Manufacturers

ELECTRICAL ITEMS

SL.NO.	MATERIAL, WORK	SUPPLIER, MANUFACTURER, VENDOR, AGENCY
1	S.F.U., Breakers	L&T, Siemens, GE, Schneider
2	Distribution Boards	MDS, Siemens, Schneider, Hager
3	Indicating Digital Meters	AE, Meco, L&T, Conzery
4	Crimping Lugs, Glands of Double Compression Type	Dowells, Jainson, Lotus, Braco
5	Jelly filled Telephone Cables	Finolex, Universal, RPG
6	Tag Block with Boxes	Krone
7	Rossets	ITL, Tele Connectors India
8	MCB, RCCB	MDS, Siemens, Schneider, Hager
9	Main L.T Panels, PDB, LDB	Incorporating L&T, Siemens, GEC, Schneider Switchgear Components, Chavare Engineering Pvt. Ltd.
10	Switches and Sockets	MDS (Leagrand), Schneider, Anchor, Cona, ROMA
11	PVC Copper Wires (FRLS Grade)	Sundeep, Finolex, RR Kabel, LAPP, Polycab
12	Motors	Siemens, ABB, Bharat Bijlee, Crompton, Kirloskar, Texmo, NGEF, Alstom
13	Cable Glands and Lugs	Dowell, Lotus, A.G. Electricals, Siemens
14	Cat-6 Lan Wire	Lucent, LAPP, AMP
15	PVC Pipe	Diamond, Precision (PPI), Asian
16	Lighting Fixtures	Wipro, Phillips, Clipsal, Crompton, Bajaj, K-Lite, Keselec Shredder
17	Fans & Air-Circulators	Crompton, Bajaj, Almonard, Usha, Cinni, Rallies, Orient, Khaitan
18	Distribution Transformer 11 KV, 433V	Crompton, Kirloskar, Emco, BHEL, Bharat Bijlee, Voltas, Andrew Xule, Pactil, NGEF, Voltamp
19	11 KV VCB Breaker & Panel	ABB, Schneider, Siemens, Alstom, Jyoti, Kirloskar, Crompton
20	Relays	ABB, Siemens, Alstom (AREVA), Schneider, L&T
21	11 KV SF6, Insulated 3-Panel, 4-Panel extensible type RMU	Crompton, ABB, Siemens, Alstom, Schneider, L&T
22	ACB 8-Way Feeder Pillar 6-Way, 4 ,	Popular Brass Metal Works, ABAK, Manish, Fitwell, Super Panel, Control & Switchgear, Chavare Engineering Pvt. Ltd.
	Way & Mini Pillars	
23	Fuse Base	Siemens, L & T, Popular Brass Metal
24	Control Cables	LAPP, Finolex
25	Batteries	Amar Raja, HBL Knife, Exide, Emco

26	11 KV End Termination & Straight through Joint	Raychem, Xicon, Danson
27	Measuring Instruments	MECO, IMP, KEW, Rishiline (L&T), Conzery
28	PVC Insulated Cable for Working Voltage up to 1.1 KV as per IS: 694: 1990	Finolex, Asian, Polycab, Reliance, Fixolite, Torrent, Universal, Fortgloster, Vardhaman, Fixolite, Macro, CCI
29	XLPE — LT Cables as per IS:7098 Part — I: 1988	CCI, Asian, Finolex, Torrent, Macro, Fixolite, KEI, Polycab with Nitrogen Corring, Gloster
30	XLPE — HT Cables as per IS:7098 Part II — 1985	CCI, Asian, Finolex, Torrent, Macro, Fixolite, Polycab, Vardhaman
31	PVC Insulated (HD) Cable up to 1.1 KV as per IS:1554 Part I — 1988	Torrent, Macro, Vardhaman, Finolex, CCI, Asian, Polycab
32	Air Conditioners	Samsung, LG, Voltas, Carrier
33	Lamps HPMV, HPSV Metal Halide Lamps & Accessories	Vallient, Fixolite, Bajaj, Philips
34	MCB, ELCB, RCCB, HRC	Indo Asian, MDS, Datar
35	T. W. Boards & Blocks	Double Folding Polished Board shall be in one Piece. Block up to 8" x 10" shall be in two Pieces
36	T. Switch S.P. or 2-Way S.A. to I.S.A.	Khosla, Keycee, GNE, Modern, Kalki
37	Three Pin Socket: 5A to 15A	Khosla, Keycee, Standard, Ellora
38	Ceiling Rose	Khosla, Keycee, Ellora, Oshan, Modern
39	Ring Main Unit, HT, Switch and Fuse Unit	MEI, South Andrew Yule or Department approved
40	C.T. / P.T.	Department approved
41	Auto Transformer Starter	MEI, Kilburn, JMP, Siemens, Andrew Yule, GEC, KEC
42	Trivector Meter	Department approved
43	Measuring Instrument	IMP, AE, UE, MECO, FE, Rishiline (L&T),
44	Current Transformer	AE, Gilbert & Maxwell, IMP, Siemens, SEGC (C.S.), VM Electric or Department approved
45	PVC Conduits, PVC Pipes, HDPE Pipes	Garware, Finolex, Shakti, Circlearc, Popular, Prince
46	GOD Switches and Dropout Fuse Outfit	Kiran, Pactil, Atas or Department approved
47	Chain Pulley Block	Elephants, Herculas, WMI
48	Lugs	Dowels, Lotus, AG Electricals
49	Motor Protection Relays	Universal, Thresold, E.E., L&T, Minilac, Siemens, C&S. Telemechanique, Indo-Asian
50	Feeder Pillar, Mini Pillar	Popular Brass Metal Works, Anil Electrical Industries or Department approved
51	MCB & MCB, D.B.	MDS, Siemens, EE, Telemechanique, Havells, Indo-Asian, Standard, Versa Trip, Helcon, Safeline, Datar, Schneider
52	ELCB	Datar, MDS, Standard, GE, Telemechanique, Havells, Safex, HH-ELCON, Naptune, Gutts, Indo-Asian, Siemens, GE, Schneider

53	PVC Wires Copper Aluminium Conductor, Flexible Cables	Philco, Phyroflux, Paragon, Polyplast, V-Plast, Apex, Silvex, Delta, Pagoda, Spacecab, HMT, Ralicab, Finolex
54	HRC Fuses	L&T, Indo Asian, Siemens, Havells, ARCON, Standard, Samrat
55	Fuse Switches, SW Fuse	L&T, Siemens, Crompton, Telemecanique, Indo-Asian, Havells, HH-ELCON, Standard, KEW, Kalki, Sentinel, Stenly, Samrat, Schneider
56	Switches, Sockets	Kalki, CPL, Anchor, Precision, MK, HME, EEW
57	Cable Glands	IIME, EEW, Conzery & Department approved,
58	HC Fuse Distribution Board	CPL, EE, Ess Ess, Stenly, KEW, Kalki, Standard
59	Air, Oil Circuit Breakers (HT,LT)	Kilburn, Easun, MEI, Jyoti, Andrew Yule, Siemens, L&T, GEC, Soutern, BHEL, Telemecanique, Crompton & Department approved
60	Energy Meters	Jaipur or Department approved
61	Capacitors	GEC, Khatau Junkar, Crompton, L&T, Momaya, Madhav, Atlanta, Prabhodhan, Maladay, Asian, Schneider, EPCOS, (S+M) or Department approved
62	Steel Tubular Poles	Indian Electric Poles, Bombay Tubes, Nityanand, Rajan Tubes or approved ISI Manufacturers
63	GI Pipes, Poles	Zenith, Tata, Bharat, Jindal, Suryaprakash
	Terminal Box, Bracket, Junction Box, ' Control Pillar	ELM, United, DVK or Department approved
65	Street Lighting Luminaries	Bajaj, Crompton, Philips, Genelec, Keselac, ELM, Mysore, Wipro, GE-Apar, Canara, Glolite, Indo-Asian
66	Chokes, Ignitors	Bajaj, Crompton, Philips, Genlec, Keselac, GE-Apar, Glolite, ECE, Indo-Asian
67	Power Contactors	L&T, Siemens, Bharat Cutter & Hammer, Telemecanique, HH-ELCON, Kirloskar, Crompton
68	Lamps	Bajaj, Crompton, Philips, Cema, HMT, Electron, Surya, Mysore, Sylvania-Laxman, Solarson, ECE, Indo-Asian
69	Rotary Selector Switches	L&T, Siemens, Kaycee, EE, BISOONS (ELM), Schneider
70	Post Top Lantern	Philips, Crompton, Glolite, Bajaj, Parimal, Tulip, Keselec, ECE, Genlec, ELM, Wipro, Indo-Asian
71	Street Light Controller, Timer	L&T, (TSQ 100) 24 hrs. Dial, ELM, GIC
72	ASCR Conductors	Department approved
73	Alternators	Kirloskar, Jyoti, NGEF, AVK-SEGC, KEL, Caterpillar, Stamford, CG Newage
74	Diesel Engines	Kirloskar, Greaves Cotton, Cummins, Ashok Leyland, Cater Piller, Perkins, Volvo, Sterling Wilson, Mahendra & Mahendra Powerica
75	Cable Jointing Kit	Raychem, Xicon, Benson, Mahindra (Push on) M Seal
76	Pole Paint	Jenson & Nicholson, Asian (S+M), Nerolac

77	Fluorescent Fixtures	Bajaj, Crompton, Philips, GEC, Genelec, Mysore, Wipro, Glolite, Litwell, Prestolite, Indo-Asian
78	Analyzers	Forbes Marshall, Endress& Hauser, Yokogawa
79	Level Switch, Level Indicator	Levcon, Revathi, Fitzer. S.B. Electro-Mechanical. Endress & Hauser, P&F, Fisher Rosemount, Forbes Marshall
80	Flow Meter — Magnetic, Ultrasonic	Endress & Hauser, Fisher Rosemount, Forbes Marshall
81	Soft Starters	Allen Bradly, Schneider, Innovative Tecno
82	Motors	Bharat Bijlee, Crompton, ABB, Siemens, Kirloskar, NGEF
83	Electrical Panels	Interlec, Positronocs, Jay Switchgear, Chavare Engineering, L&T, Siemens, ABB, Schneider, Crompton, Spark Electro

ELETROMECHANICAL & INSTRUMENTATION WORK

SL.NO.	MATERIAL, WORK	SUPPLIER, MANUFACTURER, VENDOR, AGENCY
1	Mechanical Screens— Coarse & Fine	Dorr-Oliver, Voltas, Emco, KCP, Batliboi, Jash, Shivpad, Johnson, Huber
2	Detritus Mechanism	Dorr Oliver, Voltas, Emco, KCP, Batliboi, Shivpad
3	Pumps: Horizontal Centrifugal	Kirloskar, Kishor, Johnson, KSB, Grundfos, Worthington, Mather & Platt, Jyoti, Homa
4	Pumps: Submersible	Su Motors, Kishor, Kirloskar, KSB, Grundfos, Aqua, Homa, Jyoti, Dharani, Flowmore, ABS
5	Pumps: Vertical Turbine	Kirloskar Brothers Limited, WPIL, Mather & Platt, Jyoti, Homa, Flowmore
6	Pumps: Screw (Positive Displace /Progressive Cavity Type)	o R to, Ramo, Flosys, Alfa Helical, Tushaco, Netzsch
	Pumps: Chemical Dosing (Positive Displacement Type)	Milton Roy, Swellore, Shapotools, Prominent, Sandur, Roto
8	Air Blowers	Kay, Swam, Everest
9	Turbo Air Blowers	Turbomax, DaeHa Engg., Korea Fluid Machinery
10	Air Compressor	Ingersoll Rand, Elgi
11	Fine Bubble Membrane Diffusers	EDI, OTT, Rehau
12	Chlorinators	Metito, Chloro Control, Industrial Devices, Pennwalt
13	Submersible Mixers	ABS, Grundfos, ATE, Grundfos, WILO
14	Agitators	Dorr-Oliver, Voltas, Emco, KCP, Batliboi, Shivpad, Fibre & Fibre, Standard Engineers, Helx
15	Centrifuges	Alfa Laval, Hiller, Humbolt, Pennwalt
16	Chain Pulley Block, Electrical Hoist, JIB Crane	Elephant, Hercules, WMI, Indef, Brady & Morris
17	Pipes:	
	MS / GI Pipes	Tata, Zenith, Indus tubes, Swastic, Jindal
	SS Pipes	Jindal, Lloyds, Zenith, Remi, Prakash
	CI Pipes	Kesoram, ISSCO, RIFKO, SRIF, Electrosteel, Electrotherm
	DI Pipes	Electrosteel, Lanco, Jindal

	PVC Pipes	Prince, Supreme, Reliance, Premium, Kissan, Garware
	UPVC Pipes	George Fisher, Astral
	HDPE Pipes	Hallmark, Vijay, Sangir, Sriram Polymers
	RCC Pipes	Indian Hume Pipes, Premier Prestressed Concrete Product, Patel Hume Pipes
18	Sluice Gate	Voltas, Emco, KCP, Batliboi, Jash, Yeshwant, IVC, Durga
19	Valves: Butterfly, Non-Return, Knife Gate, Gate, Ball, Globe, Diaphragm, Plug	Audco, BDK, Crane Process Control, Fouress, Intervale, IVC, Jash, Kirloskar, Vaas, H Sarker
20	MCC	Interlec, Positronocs, Jay Switchgear, Chavare Engineering, L&T, Siemens, ABB, Schneider, Crompton, Spark Electro
21	Variable Frequency Drive (VFDs)	ABB, Nord, Mitsubishi
22	PLC	Allen Bradley, Mitsubishi, GE, Siemens, Messung, Honeywell, Schneider
23	SCADA	Allen Bradley, Ellipse, Wonderware
24	Pressure Gauges	H.Guru, Gluck
25	Level Switches, Level Transmitters	Levcon, Revathi, Fitzer. S.B. Electro-Mechanical, Endress & Hauser, P&F, Fisher Rosemount, Forbes Marshall
26	PH / ORP Meters, Flow Meters, DO Meters etc.	Endress & Hauser, Fisher Rosemount, Forbes Marshall, Yokogawa
27	TOC, Turbidity, MLSS & other Analysers	Hach, ABB, GE, Yukogawa, Fisher Rosemount, Forbes Marshall

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			Annexure-8	
			Rev. No.	00

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Annexure-8

Revisions:	Prepared by :	Checked by :	Approved by :	Date :
Refer to record of revisions	Girish Prasad Palo	Siva Prasad Babu	Siva Prasad Babu	06.05.2019

MASTER DOCUMENT LIST - Scr															
	Vendor Name:				PROJECT:										
	Vendor Contact Person:				BHEL PO No.		PO date:			PO Dly. Date:					
	Vendor contact No.				Supplier's Job No.										
	SYSTEM/PACKAGE:	Screw Sludge Lifting Pump				TODAY-DATE	5-Aug-19								
Sl.No	DRG/DOC. NAME	DRG/ DOC NO.	NO. OF SHTS.	CAT	CRITICAL FOR MFG?	REQD.FOR CUSTOMER SUBMISSION?	Plan date of submission	Count of DUE as on Dt.	STATUS	Rev-0			Rev-1		
			NO.	(A / I)	(Y/N)	(Y/N)	dd-mmm-yyyy		" /PV/PB /PC/AA	SD	AD	APP.CAT	SD	AD	APP.CAT
1.0 Mechanical															
A	MECHANICAL														
1	Pump Data Sheet			A	Y	Y									
2	Pump Performance curve-Motor Driven			I	Y	Y									
3	Pump & Motor assembly GA drawing			A	Y	Y									
4	Pump Cross Sectional Drawing			I	Y	N									
5	Motor Data Sheet			A	Y	Y									
6	Motor GA drawing			A	Y	Y									
7	Motor Curves			I	Y	Y									
8	T-S Curve			I	N	N									
9	Coupling GA Drawing for Motor Driven Pump			I	Y	N									
10	Mechanical Seal GA Drawing and details			I	Y	N									
11	Relief Valve Document(Data Sheet,GAD,Catalogue etc.)			I	Y	N									
B	MISCELLANEOUS														
1	Performance Test Procedure			A	Y	N									
2	NPSH test procedure			I	N	N									
3	Vibration test procedure			I	N	N									
4	Temperature rise test procedure			I	N	N									
5	Hydro Test Procedure			I	N	N									
6	NDE Test Procedure			I	N	N									
7	Balancing_LP test & ultrasonic test procedure			I	N	N									
8	Painting proccedure			A	N	N									
9	Packing List			I	N	N									

MASTER DOCUMENT LIST - Scr															
	Vendor Name:				PROJECT:										
	Vendor Contact Person:				BHEL PO No.		PO date:			PO Dly. Date:					
	Vendor contact No.				Supplier's Job No.										
	SYSTEM/PACKAGE:	Screw Sludge Lifting Pump				TODAY-DATE	5-Aug-19								
Sl.No	DRG/DOC. NAME	DRG/ DOC NO.	NO. OF SHTS.	CAT	CRITICAL FOR MFG?	REQD.FOR CUSTOMER SUBMISSION?	Plan date of submission	Count of DUE as on Dt.	STATUS	Rev-0			Rev-1		
			NO.	(A / I)	(Y/N)	(Y/N)	dd-mmm-yyyy		" /PV/PB /PC/AA	SD	AD	APP.CAT	SD	AD	APP.CAT
10	BILL OF MATERIAL			A	N	N									
11	BILLING BREAKUP			A	N	N									
12	QUALITY ASSURANCE PLAN			A	N	Y									
13	SUB VENDOR LIST			I	N	N									
14	COMMISSIONING SPARES LIST			A	N	N									
15	Mandatory Spares List			A	N	N									
16	LUBE OIL SCHEDULE			I	N	N									
17	STARTUP PROCEDURE			I	N	N									
18	ERECTION PROCEDURE & Comissioing procedure			I	N	N									
19	INSPECTION/TESTS REPORTS/CERTIFICATE			I	N	N									
20	O& M Manuals(Soft Copies)			A	N	N									
21	O& M Manuals(Hard Copies)** ** hard copy shall be furnished after getting concurrence on soft copy.			I	N	N									
							TOTAL	0		^APP.CAT					
	A-Approval Category	PV-Commented and pending with vendor					TOTAL "PV"		0	A1-'Approved					
	I-Information Category	PB- Pending with BHEL					TOTAL "PB"		0	A2-'Mfg. Clearance given subject incorporation of comments					
		PC- Pending with Customer					TOTAL "PC"		0	A3-Commented.Revision & resubmission required.					
		AA- Approved					TOTAL "AA"		0	A4- Retained for info.					
		" " - Not yet Due.													
		OD-Overdue					TOTAL "OD"		0						
		" " - Not yet Due.													

Vendor documentation status									
Total No of Docs	Due as on Date	Submitted by vendor as on Dt.	Approved by BHEL as on Dt.	Commented by BHEL as on Dt.	Pending with BHEL/CUSTOMER as on date	%age of Dos Approved	%age of critical Dos Approved	Is Mfg. Clearance given?	Status/Remarks
(Nos)	(Nos)	(Nos)	(Nos)	(Nos)	(Nos)	% age	% age	(Y/N)./(If Y) put Dt.	
0	0	0	0	0	0	#DIV/0!	0.00%	Y	

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			Annexure-9	
			Rev. No.	00

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Revisions:	Prepared by :	Checked by :	Approved by :	Date :
Refer to record of revisions	Girish Prasad Palo	Siva Prasad Babu	Siva Prasad Babu	06.05.2019

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				Annexure-9	
				Rev. No.	00

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Revisions:	Prepared by :	Checked by :	Approved by :	Date :
Refer to record of revisions	Girish Prasad Palo	Siva Prasad Babu	Siva Prasad Babu	05.06.2019

ANNEXURE-9: DEVIATION FORMAT
[For Technical Specification, PY-51588, Rev00]

Sl. No.	Section / Part/Subsection	Page No.	Clause No.	Bid Specification Requirement	Bidder's Deviation

Notes:

1. Bidder to furnish duly filled format along with SEAL & SIGN along with their offer.
2. All the pre-bid queries (if any) shall be raised before submission of the offer as per pre-bid query format (Annexure- 10) .

3. Deviations, which are impractical, and the same were raised during pre-bid stage as per pre-bid query format (Annexure- 9) , but still purchaser's reply/clarifications could not be met shall only be raised in this format.
4. If there are no deviations, bidders shall indicate as "No deviation" and submit the same along with their offer.
5. Deviations indicated elsewhere in bidders offer except raised through this format shall not be considered and reviewed during technical evaluation of their offer.

SIGNATURE : _____
NAME : _____
DESIGNATION : _____
COMPANY : _____
DATE : _____

COMPANY SEAL

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			Annexure-10	
			Rev. No.	00

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Annexure-10

Revisions:	Prepared by :	Checked by :	Approved by :	Date :
Refer to record of revisions	Girish Prasad Palo	Siva Prasad Babu	Siva Prasad Babu	06.05.2019

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				Annexure-10	
				Rev. No.	00

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Revisions:	Prepared by :	Checked by :	Approved by :	Date :
Refer to record of revisions	Girish Prasad Palo	Siva Prasad Babu	Siva Prasad Babu	06.05.19

ANNEXURE-10: PRE -BID QUERIES FORMAT
[For Technical Specification, PY-51588, Rev00]

Sl. No.	Section / Part/Subsection	Page No.	Clause No.	Bid Specification	Bidder's Query	Purchaser's Reply

Note: During Preparation of Pre-Bid Queries, Complete Tender Specification Doc. No. PY-51588 (along with all Annexures) shall also be referred.