

**PURCHASE SPECIFICATION FOR SUBMERSIBLE PUMPS FOR
DRAINAGE, DEWATERING & FLOOD PROTECTION SYSTEM OF POWER HOUSE,
VISHNUGAD PIPALKOTI (4X111 MW)**

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1. Specification and Application:

Submersible Pump Motor sets shall be used for Drainage, Dewatering and flood protection system of Vishnugad Pipalkoti HEP, Uttarakhand. Pumps shall be Energy efficient with low power input.

The submersible pumps shall be designed for the following hydraulic condition:

S. No	Description	Qty.	Discharge	Discharge Head	Head Range	Purpose	Size of delivery
1	Submersible Pump with 60 mtr cable	5 (five)	7300 lpm	50 m	36m to 55m	Dewatering system	250 NB
2	Submersible Pump with 60 mtr cable	3 (three)	4500 lpm	50 m	36m to 55m	Drainage system	200 NB
3	Submersible Pump with 60 mtr cable	3 (three)	7300 lpm	85 m	58m to 95m	Flood Protection system	250 NB
4	Slurry type Submersible Pump with 60 mtr cable	1 (one)	7300 lpm	85 m	58m to 95m	Flood Protection system	250 NB
5	Submersible pump with 10m cable	2 (Two)	3HP		10m -15m	To empty the sump	-

The project is situated in Himalayan region where the silt content during high flow period is excessive and peels abnormally. Submersible pumps are expected to operate under silt concentration up to 3000 ppm during high flood. Reliability of the pumps on high silt laden water is of critical importance as bottoms of sump pits shall have substantial silt deposition.

Detailed petro graphical and chemical analysis can be availed at enquiry stage, if required

2. Type and Construction of the Submersible Pump:

- 2.1. The pumps shall be suitable for continuous operation, capable of pumping water with heavy silt, directly driven by electric motor rotational speed of which shall preferably be not more than 1450/1500 rpm subject to hydraulic flow conditions and operating zones of the pumps, higher speed shall be acceptable under technical/Manufacturing compulsions only.
- 2.2. The pumps shall be of vertical, double sealed, submersible type with motors of continuous duty capable of pumping raw, unscreened, heavily silt laden water. The submersible pumps shall be of a proven design suitable for solids handling. All pumps of similar capacity shall be interchangeable.
- 2.3. The material for pump impeller shall preferably be high grade cast stainless steel or better. The pump impeller shall have high efficiency multi thick vane preferably closed type with excellent abrasion and corrosion resistant properties.
- 2.4. The wall thickness of pump casing shall be suitable for heavy duty.

- 2.5. The material for shaft, hardware and fasteners shall be corrosion resistant stainless steel (AISI 420).
- 2.6. The pump impeller shall be properly balanced along with other rotating parts on proper balancing equipment to prevent vibration.
- 2.7. Two numbers heavy duty mechanical seals for submersible pumps shall be provided. In addition to the dynamic designed capabilities of the pumps, pump-motor including mechanical seals, motor sealing, cable glands, flange joints etc. shall also be designed to sustain maximum water submergence pressure for giving trouble free performance (Max Submergence to be provided by supplier in the offer).
- 2.8. The seals of should be of suitable design to prevent water from entering into the motor
- 2.9. The suction and discharge casing of the pump shall be of rugged cast iron construction. Means for preventing reverse flow shall be provided.
- 2.10. Impeller shaft bearing and motor bearings shall be designed to carry all the thrust and shock load that could be imposed by the pump and shall be capable to withstand unbalanced force develops during operation in addition to normal loading. The bearings shall be sleeve type and of bronze & rubber combination and shall be lubricated by water being pumped. The bearing shall be capable of dry start without any pre-lubrication and cooling water requirement. The thrust bearing shall be designed to carry all the thrust and shock load that could be imposed by the pump. The supplier shall be responsible and have to undertake a guarantee for the proper function of bearing and safe operation of the pump motor sets.
- 2.11. The impellers and internal water path shall be smooth and designed for high efficiency.
- 2.12. The pumps shall withstand corrosion and wear by abrasive matters within reasonable limits.
- 2.13. Shafts sealed by packing glands shall be fitted with sleeves. Seats shall be exchangeable without extensive disassembly of the pump.
- 2.14. Submersible pumps motors mounted on top of the pump shall be suitable for running dry continuously, without damage to seals, bearings or motors.
- 2.15. Overall pump-motor efficiency shall not be less than 60%. For smaller pump mentioned at Sl. No 5 in the table, over all pump motor efficiency shall not be less than 50%.
- 2.16. One set of local Pump monitoring unit to shows the leakage, moisture, temperature and other indications shall also be provided with pumps along with single length cable, as mentioned in table on page 2. Dimension of the PMU shall be provided along with offer.
- 2.17. The specified range of operation of the pumps shall lie on the stable portion of the head characteristics curve during parallel operation of pumps.
- 2.18. The equipment & accessories shall be corrosion resistant.
- 2.19. The stainless steel shaft shall be finished to close tolerances at the impeller coupling and the bearing diameters firmly secured to the shaft with key.
- 2.20. Pumps will be complete with continuous duty totally enclosed damp proof squirrel cage induction type electric motors with class H/F insulation (Temperature rise limit to class B), anchor bolts & other mounting materials.
- 2.21. The pumps shall be suitable for operation at $415 \pm 10\%$ volts, $50 \text{ Hz} \pm 5\%$, A.C with contacts for remote operation/indication.
- 2.22. The enclosures shall be water tight, dust proof & corrosion resistant in accordance with applicable standards/codes in practice.

- 2.23. Pumps shall be installed in wet sump/pit on a guide rail to allow for removal and installation of pumps without entering the wet well. The pumps shall be provided with auto-setter coupling, lifting lug, guide support, guide rail & chain separately and shall be in the scope of supplier. The material for guide support. Guide rail, bolts, hardware and chain shall be stainless steel.
- 2.24. Discharge Casing shall be of rugged cast iron construction and to be supplied with suitable Stainless Steel bolts. Discharge casing, if required, shall be provided with an Expander / Reducer Piece, with matching flange for connecting discharge of Pump casing to 200 NB pipe (219.1 mm O/D X 8.18 mm thick, flange as per class 150) for drainage pumps and 250 NB pipe (273.0 mm O/D X 9.27 mm thick, flange as per class 150) for dewatering and flood pumps, as per the table under Sl. No 1.0.
- 2.25. Discharge casing of each pump shall be hydraulically pressure tested at a pressure of 1.5 times of the maximum design pressure at supplier's workshop. The test certificates shall be furnished to BHEL.
- 2.26. General Arrangement of pumps shall be as per enclosure, Sketch No.-1. The supplier shall also furnish the Technical particulars of all pumps as per enclosure, Annexure –2.
- 2.27. Minimum submergence for start and stop shall not be more than 1000mm. Continuous operation of pump motor set to be considered for the above minimum submergence.

3. Electric Motor:

- 3.1. Construction shall, generally conform to IS-325.
- 3.2. RPM shall not be more than 1450.
- 3.3. Each pump shall be provided with an energy efficient electric motor of suitable capacity for the duty specified. Motor rating shall be at least 10% in excess of maximum brake horsepower required in the entire range of pump operation. It should be suitable for continuous duty.
- 3.4. The motor shall be designed for 415 + 10% volts, 3-phase, 50 Hz + 5%, A.C. supply.
- 3.5. Joint less and submersible cables shall be provided. The size/selection of the cable should be such that, in normal condition, the voltage drop is not be more than 1%, from motor to starter panel & in starting condition, it should not be more than 5%.
- 3.6. The starting current at full voltage shall not exceed 6 (six) times the rated current.
- 3.7. Mode of starting of the motor shall be star-delta.
- 3.8. Winding and insulation: - The insulation of all motors shall be of class F but maintain in operation the temperature limits of class B materials. The stator winding shall be suitably braced to withstand the forces due to direct-on-line starting. The winding envelopment and tails shall be non-hygroscopic. The stator winding shall withstand the maximum fault current for the period determined by the associated protective devices.
- 3.9. Degree of protection shall be IP68 as per relevant Indian / International Standards.
- 3.10. Starter for the motors shall be procured by BHEL / BHEL's Customer.
- 3.11. The starting torque of the motor shall be suitable for the pump application. The motor shall be suitable for frequent start and stop duty.
- 3.12. Supplier shall have to supply minimum length of cable, as shown in table on page 2, in single length along with the motor. The datasheet of the cable should be submitted as per relevant IS.
- 3.13. The motor should be provided with protection from high and very high bearing temperature.

- 3.14. The motor shall have built-in moisture detector along with discrete signal convertor to give 4 no. potential free contacts for alarm SCADA control in starter panel.
- 3.15. The motor shall have built-in thermistor along with discrete signal to give 4 no. potential free contacts for alarm SCADA control in starter panel.
- 3.16. The contacts from thermistor & moisture detector shall be used in starter panel for switching of pumps.
- 3.17. The motor terminal box shall have water tight cable entry arrangement and firmly fixed to the motor frame. The terminal studs shall be so sized as to be adequate for current duty required and shall be identifiable. Supplier shall give details of terminal arrangement and terminal size in the technical offer.
- 3.18. Each motor shall be tested at manufacturer's workshop to confirm compliance with the requirements. Each motor shall be tested for IR & HV, no load running and reduced voltage running etc. The supplier shall have to furnish Test Certificates for routine tests (for each motor) and type test (for the batch).
- 3.19. Workshop tests: - i) Measurement of winding temperature, ii) No-load and short circuit measurement
iii) Measurement of starting current and torque, iv) Efficiency measurement (type test), v) Heat run test, vi) Dielectric test, vii) Measurement of insulating resistance, viii) Over speed test.

4. Guide Rail and Foundation:

- 4.1. Guide rail shall form a part of the pump. The supplier shall have to furnish the size and details of foundation. The guide rail and foundation details including loads etc should suit the arrangement given in the enclosed sketch. Material shall be Stainless Steel.
- 4.2. Foundation bolts, hardware required for mounting pump and motor i.e., guide rail / support shall be supplied along with the pump-motor set. For maintenance, pumps shall be supplied with auto setter coupling, lifting lug, guide support, guide rail and chain and the material shall be stainless steel.

5. Special Tools:

A set of special tools, required for Erection, Operation and Maintenance of the Pump-Motor sets shall also be supplied.

6. Set of Spares:

The supplier shall have to quote for a set of spares as per Table-2.

7. Painting

Surface preparation	Paint System	Main dry Film thickness in μm
Sa 3 and de-grease before painting	<u>Prime Coat:</u> 2 x zinc chromate primer, 2- Component base: epoxy resin.	2 x 40

	<u>Finish Coat:</u> 2 x topcoat, 2- Component base: epoxy resin	2 x 50
	Total	180

The complete protection shall be applied in the shop, except when expressly waived by the Customer, and on site intervention shall be limited to touch-ups.

8. Transport & Installation:

- 8.1. General
- 8.2. From the time of manufacturing until commissioning all parts/pump shall be protected & insured at the contractor's expense against damage of any kind. Parts, which are damaged during transport, storage, erection or trial operation, shall be replaced at the supplier's expense.
- 8.3. Packing
- 8.4. The supplier shall do proper packing to protect from damage in transit & shall be responsible for make good all damage due to improper preparation, loading or shipment. Before dispatch all items, pumps and motors shall be packed in wooden cases suitable for long storage and to prevent any kind of minor or major damage or pilferage during transportation or storage. Instruments, if any is to be packed separately, in thermocol covered by polyethylene sheet with silica gel and placed in a carton or case with adequate cushioning material to avoid damage or pilferage during transportation or storage.

9. Inspection and Testing:

- 9.1. Inspection and testing shall be carried out as per QA plan approved by BHEL and / or Customer or Customer's Representative at supplier's workshop before dispatch.
- 9.2. Combined performance tests on these pump-motor sets shall be carried out as per relevant IS or International standards at supplier's workshop in the presence of Customer's representative. Supplier has to furnish his QA plan indicating the details and method of inspection / testing and performance testing along with the offer for BHEL / Customer's approval. A notice period of 30 days shall be given for inspection and witnessing the performance test.
- 9.3. Supplier shall furnish the result of Inspection and performance for BHEL / Customer's approval for dispatch.
- 9.4. Final inspection and testing shall be not limited to the following:
 - i. Certificates for calibration of test rig instruments.
 - ii. Material test certificates, hydraulic test and Static / dynamic balancing reports and NDT, dimensional and Inspection records of equipment.
 - iii. Each pump motor set shall be tested for performance tests as per relevant standards to ensure reliability of workmanship. The performance test shall include proving of duty points, measurement of discharge, dynamic head, efficiency of pump etc. It shall also include measurement of temperature of motor, pump and motor bearings.

- iv. After performance test, the pump assembly will be dismantled for inspection of water passage and Impeller.
- v. Routine tests of all pump motor sets.

Note: Pump and motor unit shall be tested as a whole, individual testing of pump and motor is not acceptable. Testing of pumps with test rig motor is not acceptable.

10. Guarantee Clause:

Guarantee conditions including period shall be as per Enquiry.

11. Details to be furnished along with the Offer:

The supplier shall have to furnish two sets of certified copies of the following documents, along with the offer.

- i. Head v/s discharge curve.
- ii. Efficiency curve.
- iii. Drawings and catalogues showing overall dimensions of Pump & Motor including their weights.
- iv. Sectional assembly drawing having details of MOC of major components.
- v. Loads on foundation and mounting detail of pump and motor.
- vi. Suction and delivery connection details.
- vii. Technical particulars and dimensions of the motor and pump as per enclosed Annexure-2 & 3 and Sketch-1.
- viii. QA Plan

SUPPLIER TO NOTE THAT IF ABOVE DOCUMENTS / ANY INFORMATION AS SOUGHT ABOVE, ARE NOT FURNISHED ALONG WITH THE OFFER, THE OFFER SHALL BE REJECTED.

12. Details to be furnished after Placement of Order (for BHEL / Customer's approval):

The supplier shall have to furnish following documents to BHEL, immediately after placement of order:

- i. 6 (three) copies of QA Plan
- ii. 6 (three) prints of Pump-Motor set drawings indicating overall dimensions and details of pump and motors and their arrangement.
- iii. 6 (three) copies of foundation details of pump-motor set, mounting arrangement of columns and support guide etc.
- iv. Catalogue / drawing of pump-motor sets showing complete inner details along with complete Bill of Material.
- v. 6 (three) copies each for Arrangement drawing, detailed drawing of terminal box, details of bearings and sealing, details of discharge case coupling (quick type) and support guide for pump motor etc.

Note: Manufacturing shall have to be commenced only after the approval of drawings.

13. Details to be furnished prior to dispatch of the material / equipment:

The supplier shall have to furnish the following documents to BHEL prior to dispatch of the equipment.

- i. 10 (ten) sets of Operation and Maintenance manuals along with catalogues and drawings and packing list of spare parts.
- ii. 7 (seven) copies of test certificates / test reports / balancing reports / inspection records and performance test certificate / Guarantee Certificate of Pumps and Motors.
- iii. 7 (seven) copies of sectional arrangement drawings of pump motor set with part number and description with major dimensions, clearances and bill of material.
- iv. In addition to above, all drawings. Operation and Maintenance manuals and all other documents shall also be supplied on CD in an Electronic media. All the drawings shall be prepared in AutoCAD latest version.

14. Details to be furnished at the time of dispatch of the material / equipment:

The supplier shall have to furnish the following documents to BHEL at the time of dispatch of the equipment.

- i. To purchaser (BHEL) – 5 copies
- ii. Inside each case / package – 1 copy of list of items contained in that case.

Note: Shipping list should also contain the following information for each case / package.

- i. List of items contained in the case, giving drawing / catalogue number, item number in BOM, description of items and quantity.
- ii. Case number, dimensions and gross weight of the case and net weight of the items.
- iii. All items shall have to be dispatched in suitable wooden cases (crate packing is not allowed) to prevent damage / pilferage during transportation or long storage

Table-1: Material Specification for Submersible Pump (As per Clause no. 2)

Sl. No.	Item Description	Grade of Material Required
1	Discharge Casing	Rugged cast iron
2	Guide Rail	Stainless Steel
3	Shaft	Corrosion resistant Stainless Steel
4	Impeller	Cast stainless steel
5	Sleeves	Stainless Steel
6	Discharge Elbow	Rugged cast iron
7	Suction Bell	Rugged cast iron

8	Shaft Coupling / fasteners	Corrosion resistant Stainless Steel
9	Wear Rings	Wear resistant stainless steel or better
10	Suction strainer (If, applicable)	Stainless Steel
11	Foundation Bolt	Stainless Steel

Table-2.1: Spares for dewatering Submersible Pumps for each type of pump

Sl. No.	Description	Qty.
1	Pump Impellers	1 Set
2	Pump bearing	1 Set
3	Pump suction sealing rings	1 Set
4	Pump motor bearing	1 Set

Table-2.2: Spares for drainage Pumps for each type of pump

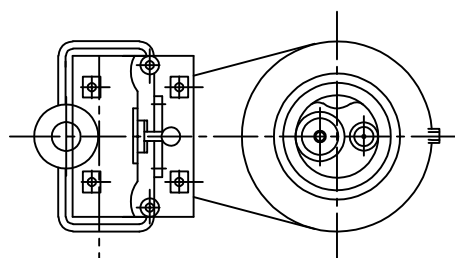
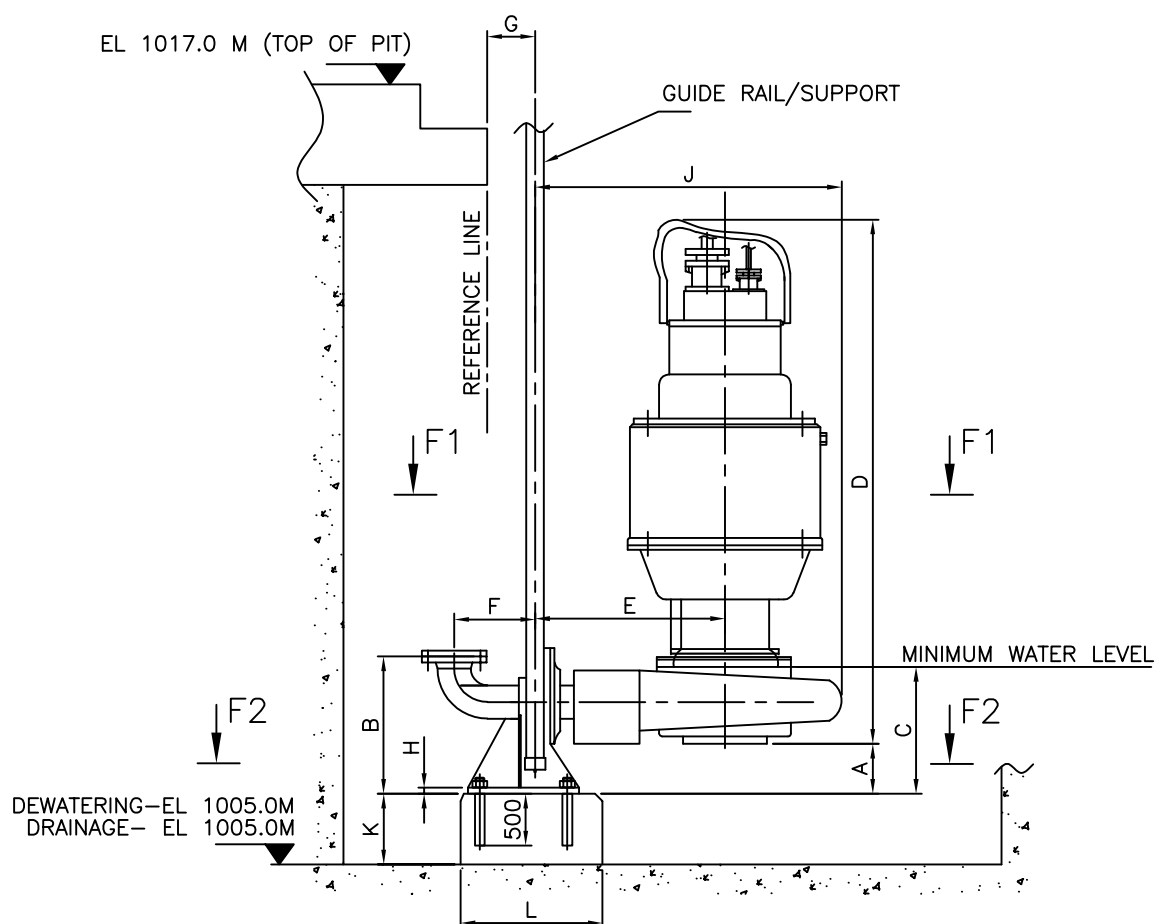
Sl. No.	Description	Qty.
1	Pump Impellers	1 Set
2	Pump bearing	1 Set
3	Pump suction sealing rings	1 Set
4	Pump motor bearing	1 Set

Table-2.3: Spares for flood Submersible Pumps for each type of pump

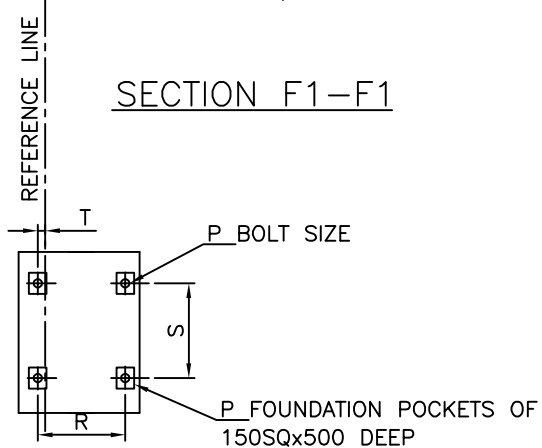
Sl. No.	Description	Qty.
1	Pump Impellers	1 Set
2	Pump bearing	1 Set
3	Pump suction sealing rings	1 Set
4	Pump motor bearing	1 Set

Note:

- a. In table – 2.1,2.2,2.3, Set means quantity required for one unit / pump.*
- b. Price for spares shall be quoted separately, item wise.*



SECTION F1—F1



SECTION F2—F2

SKETCH—1
SUBMERSIBLE PUMP