



An ISO 9001
Company

Bharat Heavy Electricals Limited

(High Pressure Boiler Plant)

Tiruchirapalli – 620014, TAMIL NADU, INDIA

MATERIALS MANAGEMENT / CAPITAL EQUIPMENT

ENQUIRY NOTICE INVITING TENDER	Phone: +91 431 257 7653 Fax : +91 431 252 0719 Email : skaruna@bheltry.co.in Web : www.bhel.com
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TWO PART BID	Enquiry Number:	Enquiry Date:	Due date for submission of quotation
Tender to be submitted in Two Parts	2731100015	dt.20.12.2011	dt.21.01.2012

You are requested to quote the Enquiry number date and due date in all your correspondences. This is only a request for quotation and not an order.

Please note that under any circumstances both delayed offer and late offers will not be considered. Hence vendors are requested to ensure that the offer is reaching physically our office before 14.00 Hrs on the date of tender opening

Item No.	Item Description
10	Supply of 3 Nos. of Stainless Steel (Grade 304L or better) Horizontal Type Pumps with drive Motor mounted on a common base along with VVVF drive each as per the Technical Specification, & Commercial Conditions applicable (to be downloaded from web site www.bhel.com or http://tenders.gov.in)
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Important Points to be taken care during the submission of offer:-

1. Check list to be filled and enclosed along with the offer failing which, the offer will not be considered for evaluation.
2. Guarantee for the Items to be 18 months from the date of supply or 12 months from the date of commissioning.

BHEL's General guidelines /instructions including bank guarantee formats and list of consortium banks, commercial terms checklist can be downloaded from BHEL web site <http://www.bhel.com> or from the government tender website <http://tenders.gov.in> (public sector units > Bharat Heavy Electricals Limited page) Tender Enquiry reference "2731100015"

Tenders should reach us before 14:00 hours on the due date Tenders will be opened at 14:30 hours on the due date Tenders would be opened in presence of the tenderers who have submitted their offers and who may like to be present	Yours faithfully, For BHARAT HEAVY ELECTRICALS LIMITED Manager / MM / Capital Equipment
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TECHNICAL SPECIFICATION FOR STAINLESS STEEL PUMP WITH MOTOR AND VVVF DRIVE

Specification No.	Rev No.	No of Sheets
NPS:D100:001	02	08

ENGG/ATP	ENGG/ATP	M&S	ENGG/ATP	M&S
Prepared	Checked		Approved	

Technical Specification for supply and Installation of Pumps with motor and VVVF

1. BHEL have designed and installed at our works a Hot Water Flushing system for generating and circulating hot DM water at around 100 deg C through a closed loop, as shown in the enclosed Lay out drawing 20-T-33-28530. The system consists of an SS Centrifugal pump which takes suction from an SS tank and circulates the water through a set of filters and valves connected through a system of pipelines and finally return the water to the tank. The tank size is 2200 mm dia and 2700 mm height and is mounted on two pedestal at a height of 2500 mm.

In order to make use of this existing system for different range of flow rates, it is now proposed to add to this system three more centrifugal pumps with motor and VVVF drive as specified herein.

These items have to be installed at our works and connected with the existing flushing system. Hence, the suppliers shall visit our works to study and familiarize with the available system before submitting the offer. During the visit, the supplier shall also take measurements for power cables, control cables and cable tray / conduit.

2. Item description: Horizontal type centrifugal pump, driven at varying speed by an electrical motor (both pump and motor to be mounted on a common base plate). The motor to be driven by using a VVVF drive.
3. Quantity: 3 Sets. (Refer Data Sheet)
4. Fluid handled: High quality DM water.

5. Scope of supply / work:

- a) 3 No Stainless Steel Pumps with a drive motor mounted on a common base frame
- b) Suction strainer with SS-316 internals for each pump. The strainer should be of removable type with free flow area of 4 times the flow area of pipe.
- c) Supply of VVVF Drive Unit for each pump to vary the motor speed and hence the pump flow rates as indicated in the data sheet.
- d) 1 set of complete instrumentation necessary for each pump (along with instrument tubing, fittings, isolation and drain valves) for the safe and reliable operation of the pump to be mounted on a local gauge rack fixed to the pump base of the unit
- e) 1 No. of coupling with spacer and non-sparking coupling guard etc., between pump and driver.
- f) 1 set of erection & commissioning spares and spares for 1 year continuous operation as recommended by supplier (to be included in main offer but the list to be furnished separately).

- g) Supply of power cables/ control cables, cable trays/conduit etc.
- h) Spare VVVF drive for each pump.
- i) Installation, erection and commissioning of the items.
- j) Training for two maintenance people at VVVF drive manufacturer's work for a period of not less than 2 working days on VVVF drive programming, maintenance and troubleshooting. The boarding, lodging & travelling expenses will be borne by BHEL.

6. Data Sheet

	Description	Pump 1	Pump 2	Pump 3
01	Discharge Capacity	40 m ³ /hr	12 m ³ /hr	160 m ³ /hr
02	Discharge head	50 Metres	40 Metres	50 Metres
03	Operating flow rates and Head required	10 m ³ /hr at 40 M Head to 35 m ³ /hr at 50M Head	2 m ³ /hr at 30M Head to 10 m ³ /hr at 40M Head	90 m ³ /hr at 40M Head to 135 m ³ /hr at 40M Head
04	Suction type	Flooded from a height of 2.5 metres		
05	Design pressure	15 Kg/sq.cm		
06	Design temperature	100 deg C		
07	Type of flow control	Through VVVF Drive		
08	Discharge Nozzle size	65 NB		
09	Suction Nozzle size	80 NB		
10	End connections	With corresponding size flanges		
11	Seal type	Mechanical		
12	Material of construction	Stainless Steel -Grade 304L or better		
13	Type of motor	Squirrel cage induction motor suitable for VVVFD		
14	Motor / VFD Power rating	To suit the pump requirement		
15	Motor Speed	To match with the varying flow rates of the pump		

7. Technical requirements for Pump

- i. Design and construction of the pumps shall comply with API 610. Pump-motor with Variable Speed Drive units shall be suitable for continuous service and designed with regard to ease of maintenance, inspection and service. Workmanship shall be in accordance with the best practice presently followed in the manufacture of centrifugal pumps, adequate to ensure long and trouble free operation and ease of maintenance.
- ii. The units are to be located in an area where temperature and humidity conditions of a normal industrial area shall be assumed.
- iii. Pumps shall be directly coupled to the motor by means of flexible coupling which shall be capable of taking care of shaft misalignments during operation. The flanged end connections at the discharge and suction nozzles shall conform to ANSI B 16.5
- iv. The unit shall be free from undue vibration. The rotating components shall be balanced mechanically and hydraulically. Vibration and noise levels shall be reasonably low and comply with the requirements prescribed in API 610 / hydraulic institute standards.
- v. All the components coming in contact with the fluid pumped i.e. de mineralized water shall be of corrosion resistant material only.
- vi. Use of any material like graphite, bonding/ lubricating material etc. that are likely to contaminate the system during operation is totally prohibited. Materials for packing and gaskets that are likely to degenerate during continuous operation shall not be used. Flange joint design shall be such as to contain the gaskets within the flange facings without protrusions on the ID.
- vii. Pump shaft shall be provided with a balanced mechanical seal suitable for the intended service.
- viii. Pump end shall be provided with vent and drain connections to enable complete venting and draining.
- ix. Spare parts required for continuous operation of the pump for one year shall be supplied along with the pump.
- x. It shall be possible to maintain the unit with normal skills and tools available in a normal industry. Any special tool or fixture required for the maintenance shall be identified and supplied along with the unit.
- xi. All major and pressure retaining materials designated to be in conformance with ASTM specifications shall be tested and examined as per the specifications and certified material test reports shall be provided for proving their compliance.

- xii Pressure retaining castings (casing etc) shall be examined by radiography to the extent possible as per the relevant material specification / Section VIII. Casing, impeller and shaft shall be examined for surface discontinuities by means of LP method.
- xiii The pump after completion of assembly shall be hydro tested at 1.5 times the design pressure.

8. Technical requirements for Motor and VVVF Drive

- i. Motor shall be of 3 phase squirrel cage induction type and shall be suitable for being driven by Variable Speed Drive and they shall be procured only from reputed manufacturers. Specifications of the motor in general shall be in compliance with IS:325 standards.
- ii. Motor and Variable speed drives shall be suitable for operation with the normally observed fluctuations in the 415 V, 50Hz power supply. Contactors and FSU units shall be SIEMENS / L&T make.
- iii. All the motors shall be High Efficiency (Energy efficient) motors as per IS12615, EFF-1
- iv. Class of insulation and the motor windings shall be suitable for the rated operating conditions and the specified ambient conditions.
- v. Type tests and Routine tests as per IS:325 shall be carried out by the motor manufacturer, the results of which shall be the basis for acceptance of motor for its performance.
- vi. The routine quality control checks proposed and followed by motor/ VVVF manufacturers shall be obtained from them and backed up with documents.
- vii The motor shall be of following make: ABB, SIEMENS, KIRLOSKAR, CROMPTON GREAVES, ALSTOM
- viii The VVVF drive shall be of following make: ABB, SIEMENS, L&T, Eurotherm.
- ix The VVVF drive shall be selected in such a way that it generates only the least unavoidable harmonics.
- x A control panel suitable for accommodating the three VVVF drives along with its switchgears to be provided. The control panel shall have the following provisions:
 - a. MCCB / SFU for isolating the Incoming Supply.
 - b. Push buttons for Start, Stop, Increase, decrease & reset – for each pump control.
 - c. Ammeter with selector switch for displaying motor current for each pump motor. Accessories like Current Transformers, etc., also to be supplied
 - d. Mushroom type Emergency Push button for each pump.
 - e. Indication lamp for drive Start, Stop & Trip indication for each drive.

- f. Suitable air cooler for the control panel.
 - g. Suitable Filter & Choke for the drives.
 - h. Control transformer for auxiliary voltage.
 - i. The control voltage shall be 24V AC / DC and the required switchgears for the same shall be supplied.
 - j. Should be provided with florescent lamp for sufficient illumination and power receptacles of 230 V AC, 5/15 Amp.
 - k. All switch gears, switches shall be of reputed make like SIEMENS, L&T, Tele-mechanique, ABB
- xi An energy meter with the following specifications shall be provided in the Main control panel. The accessories required for the energy meter shall be supplied and erected.
- a) Voltage (Ph to Ph, Ph to N) (Individual / Average)
 - b) Current (I1,I2, I3)(Individual / Average)
 - c) Frequency
 - d) Power Factor
 - e) Active, Reactive & Apparent Power (Individual / Average)
 - f) % THD Display for Current & Voltage Harmonics
 - g) Active, Reactive & Apparent Energy (Individual / Average)
 - h) Inbuilt provision for RS 485 Communication with Modbus protocol
 - i) Meters shall also support Minimum 2 Digital Inputs & 2 Digital Outputs and shall be controlled from Remote monitoring System.
- xii Considering the application, each pump shall have independent VVVF drive.
- xiii Power & control cables required for connecting the motors with VVVF drives, shall be supplied. All the cables shall be copper and shall be laid through cable tray / conduits / flexible hose.
- xiv BHEL will provide 3 phase, 415V supply (without neutral) for the control panel. The input cable for the control panel will be supplied by BHEL.
- xv The switchgears used in the panel shall be of reputed make like ABB, SIEMENS, L&T.
- xvi The power & control cables shall be of reputed make like Lapp.
- xvii The push buttons shall be of make SIEMENS, TEKNIC or equivalent.
- xviii Technical catalogue of the offered drive & motor to be submitted along with the offer for evaluation.
- xix The successful bidder shall submit the electrical drawings, panel layout along with BOM for approval before manufacturing / procurement.
- xx The supplier shall offer the materials for inspection before dispatch.
- xxi The drive panel shall be dust & vermin proof and shall have IP 55 protection. The thickness of the sheet used for fabricating the panel shall be 2 mm.

- xxii Along with the materials 3 hard copies & 1 soft copy (in CD) of the following manuals submitted:
- (i) Installation & Programming manual of VVVF drive
 - (ii) Maintenance manual of pump
 - (iii) O & M Manual
 - (iv) Electrical circuit diagram with Bill of material
 - (v) Test certificates, test data and Performance curves of pumps & motors.

9. Testing requirements

- i. The complete unit shall be inspected and tested for performance in accordance with Hydraulic Institute standards or ASME PTC 8.2 at varying motor speed and at rated power supply. Pump total head, power input to motor, pump efficiency, NPSH required, vibration and noise levels shall be determined for the unit at flows ranging from shut off to at least 125% of rated flow. The pump characteristics curves shall be generated with appropriate temperature correction factors to indicate performance at operating conditions. The supplier shall offer inspection of pump testing by BHEL official at free of cost. The boarding, lodging & travelling expenses will be borne by BHEL.
- ii. The motor with VFD which will be part of the final assembly shall only be used for performance test. During the test, performance shall be judged on the basis of the following measurements- voltage and current drawn by motor, pump flow and head for varying speed, vibration and noise levels, temperature of bearings and motor body. Problems, if noticed during the course of testing, shall be rectified to the satisfaction of the Purchaser and retested for satisfactory performance.

10. Documents required along with offer

- i. Performance curves showing flow rates and heads versus RPM
- ii. Design characteristic curves showing flow versus head, power, efficiency
- iii. Cross sectional drawing of pump indicating constructional details along with Part list and material of construction (with relevant ASTM or equivalent specification numbers) of various components.
- iv. Outline view of the pump-motor with Variable Speed Drive unit indicating mounting details on base plate, overall dimensions, foundation details various nozzle terminations etc.
- v. Quality plan
- vi. Technical catalogues of the offered pump, motor and drive.
- vii. List of spare parts along with identification of the same on cross sectional drawing enclosed with offer.

- viii List of instruments
- viii. Specific point wise confirmation on all clauses of this specification. Deviations, if any, to be furnished

List of sub vendors for motor and VVVF Drive.

- ix. Pump data sheet consisting as a minimum of manufacturer, model no., type, rated capacity, head, required NPSH, efficiency at rated condition, number of stages, BHP at 20% to 125% capacities, shut off head, minimum flow through pump, material of construction with specification numbers of various components, suction and discharge sizes and the type of end connections, type of bearings and seals, lubrication and cooling requirements, details of accessories, overall size and weight.
- x. Motor and VVVF Drive Data sheet consisting as a minimum of make, frame size, kW rating at rated load, motor rating, electrical power input required with the variations permissible, starting current, full load current, restrictions on number of starts, if any, overload capacity, details on insulation like class, material temperature rise expected, types of bearings, requirement of cooling and lubrication, grounding devices, speed-torque characteristics etc.
- xi. Installation instructions, operation and maintenance manuals / schedules for the unit from the manufacturer shall be submitted.
- xii. List of 5 years normal operation spares as recommended by supplier with unit rates to be furnished separately. This shall not be included in the quoted price.