

MAHAGENCO
1x660 MW BHUSAWAL TPP (UNIT-6)

**TECHNICAL SPECIFICATION
FOR
MISCELLANEOUS PUMPS (VERTICAL)**

Specification No. : PE-TS-415-100-N011 (REV. 0)



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
PPEI BUILDING, SECTOR 16 A
NOIDA - 201301**



TITLE:
**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-415-100-N011**

SECTION:

SUB-SECTION:

REV. NO. **00** DATE 10.12.2019

SHEET **1** OF **1**

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Notes:

1) For detailed list of documents to be submitted by bidder in their technical offer, please refer cl. no. 15.00.00 of Section-IIA.

2) For detailed list of documents to be submitted by vendor after award of contract, please refer Datasheet-C of Section-IIA.

3) In case there is conflict in different clauses of specification, most stringent clause (as decided by BHEL / end customer) shall be followed, if no specific deviation is taken by bidder and accepted by BHEL during tender stage in that regard.



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SECTION - I

SPECIFIC TECHNICAL REQUIREMENTS

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TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-415-100-N011**

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SUB-SECTION – IA

SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)

	TECHNICAL SPECIFICATIONS MISCELLANEOUS PUMPS SPECIFIC TECHNICAL REQUIREMENTS		Specification No. : PE-TS-415-100-N011, Rev0	
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			DATE:	01.01.2020
1.0 SCOPE				
1.1 This enquiry covers the design, manufacture, assembly, inspection and testing at manufacturer's and/or his sub-contractors works, proper packing for delivery and installation checks and replacement of gland packing with Mechanical Seal arrangement (if applicable) at site and PG Test at site for Miscellaneous Pumps along with mandatory spares complete with all accessories as per the requirements specified in this specification and also including Sump model study and any other services, etc. if called for in the succeeding sections of the specification for following project:				
A. 1X660 MW BHUSAWAL TPP UNIT-6 (MAHAGENCO)				
The above project is referred as '1X660 MW BHUSAWAL' elsewhere in the Specification for ease of reference.				
NOTE:-				
1. The bidder shall include complete supplies for Pumps as covered in this Technical Specification. Part supplies offered for the Pumps shall disqualify the bidder's offer.				
2. Pump details shall be as per Data Sheet-A at Section-ID.				
1.3 The miscellaneous pumps and drives covered under this specification for various projects are as per Annexure-1 of this section. HT drives, wherever applicable and irrespective of motor ratings, shall be issued free of cost by BHEL. The details of pumps with HT drives shall be as per Annexure-2 of this section.				
1.4 The Capacity, Head, Materials of construction, Mandatory spares and other particulars of these pumps, are detailed in Data Sheet-A at Section-ID of the specification.				
1.5 For detailed scope of supply & services for Vertical pumps, refer Standard technical Specification for Vertical Centrifugal pumps specified under Section-II of this specification.				
1.6 DELETED				
1.7 <u>DELIVERY:</u> Delivery of miscellaneous pumps shall be as per NIT requirement.				
1.8 Evaluation and LD criterion w.r.t. Auxiliary Power is defined at clause 4.0 of Section IIA of this specification. In case bidder quotes Aux. power less than Benchmark Auxiliary Power, then quoted Aux. power shall be replaced with Benchmark Auxiliary Power for both evaluation as well as LD purposes.				
2.0 Additional requirements for Pumps:				
2.1 End Customer specific requirements are indicated as Annexure-3 In this section, same are also to be complied. In case of any contradiction with other clauses of Section-IA, the stringentmost requirement is to be complied.				
2.2 <u>For Vertical Pmps:</u>				
2.2.1 All Vertical pumps & their drive motors shall be designed/capable of withstanding max. run away speed during reverse flow.				
2.2.2 Thrust block are not envisaged for pumps. Bidder to design the pump foundation system (base plate/ sole plate, discharge head, foundation bolts etc.) capable of transferring the pump thrust to the concrete pump foundation itself.				
2.2.3 Sump Model Study to be conducted for Raw water Pump House & Clarified Water pump house (Non DM) by the Bidder.				
Dimensions of pump chamber/ sump in the Pump house shall be fixed up initially by BHEL based on Hydraulic Institute Standard (Preliminary Layout is attached as Annexure-4). The dimensions shall be confirmed by Pump Vendor by conducting a Hydraulic Model Study at a recognised Institute/ hydraulic research laboratory(subject to BHEL/End Customer Acceptance of Sump Model Study/Testing Agency). Scale of the model shall be 1:10. The hydraulic model study shall be conducted to study water level in the pump sump, flow conditions in the pump sump for different discharges & different depths of water, different combinations of pump operations to study velocity distribution in pump bays, etc.				
The model shall be based on Froude's law of similitude and shall also be tested for following two more flow conditions, viz.				
a. At twice the prototype maximum Froude number, i.e., the Froude number of the model is two times that of the prototype.				
b. At equal velocity criterion, i.e., the velocity is same both in the model and prototype.				
The final recommendation shall be based on 2F condition. Based on recommendations of the hydraulic model study, necessary modifications shall be made in the pump sump, forebay & channel, additional structural features required such as flow straighteners, baffle walls, mesh screens, grid walls, guide vanes, floor splitters, anti - swirl cone etc. for elimination of non - uniform velocity distribution, swirls and vortices in the model etc.				
Pump Vendor shall furnish procedure for Sump Model Study within One (1) month from LOI. BHEL and/or End Customer shall review/approve the Procedure for Sump Model Study and physical test conductance shall be intimated by the Pump vendor in advance for witness of Sump Model Study by BHEL/End Customer as per Approved Procedure.				

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2.2.4 For all HT Motor driven Vertical pumps, following instruments/accessories to be provided:

All the Pumps with HT Drives shall be provided with RTDs for each Pump bearing temperature monitoring / tripping. Specification for RTD are attached at Section-1C.

2.2.5 Intake water booster pumps shall be installed in already available pump house with existing foundation details indicated at Annexure -5. Bidder to select/design this pump including foundation bolts in such a fashion that quoted pump shall have pump sole/base plate to match existing foundation for pump mounting.

3.0 Vibration, Noise and Parallel run test (as applicable) for all pumps shall also be conducted by bidder at site as per approved PG Test Procedure, inline with Cl no. 3.04 of Section-IIA of this specification. Mechanical run test along with Performance test shall be carried out on all pumps to determine the vibration levels, noise levels etc. at Vendor works. However, test value at site shall be used for the acceptance of the equipment. Pump vendor shall bring necessary instruments for conductance of site performance test. If the site performance is found not meeting the requirements in any respect as specified, then the equipment shall be rectified or replaced by the vendor, without any commercial implication to BHEL.

4.0 Additional Dispatch Requirements:

MDCC after final inspection shall be provided to vendor on the basis of following:-

4.1 List of items packed in each box with description & quantity.

4.2 Photograph of each box in open & closed condition.

4.3 Bidder to include handling instructions in engineering drg/doc and packing to be done in such a way to avoid damage of items in transit and long storage at site and same shall be approved in Contract stage by BHEL/Customer

5.0 Drawing/Document Submission Schedule:

MISC. PUMPS (VERTICAL)	Primary Documents		
	PE-V6-415-100-N001	TDS AND PERFORMANCE CURVES- MISC. PUMPS	R-0 within 21 days from LOI/PO & subsequent revisions within 10 days of comments received from BHEL.
	PE-V6-415-100-N002	GENERAL ARRANGEMENT AND CROSS SECTIONAL-PUMPS	
	PE-V6-415-100-N004	QP-MISC PUMPS - VERTICAL	
	Secondary Documents		
	PE-V6-415-100-N007	O& M MANUAL -VERTICAL PUMPS	Within 30 days from MDCC
	PE-V6-415-100-N008	PG TEST PROCEDURE -VERT. PUMPS	R-0 within 21 days of Cat-I(or)II approval on pump document.
	PE-V6-415-100-N009	PROCEDURE FOR SUMP MODEL STUDY	Within One (1) month from LOI



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Annexure-1

List of Miscellaneous Pumps and drives for :

A. 1X660 MW BHUSAWAL TPP (MAHAGENCO)

Sl. No.	Pump Description	Total Qty.	Type of Pumps
	Vertical Pumps		
1	POTABLE WATER PUMPS (PLANT)	2 nos.	Vertical
2	POTABLE WATER PUMPS (COLONY)	2 nos.	Vertical
3	APH/ESP WASH PUMPS	2 nos.	Vertical
4	SERVICE WATER PUMPS	2 nos.	Vertical
5	SCR PUMPS	2 nos.	Vertical
6	CT MAKEUP PUMPS	3 nos.	Vertical
7	AHP PUMPS	2 nos.	Vertical
8	FGD PUMPS	2 nos.	Vertical
9	INTAKE WATER BOOSTER PUMPS	3 nos.	Vertical
10	ASH WATER PUMPS	2 nos.	Vertical
11	RAW WATER PUMPS	3 nos.	Vertical
12	ACW PUMPS	2 nos.	Vertical

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Annexure-2

Following HT drives for 1X660 MW BHUSAWAL TPP (MAHAGENCO), irrespective of Motor ratings shall be issue free, by BHEL:

Vertical Pumps:

- 1 ACW PUMPS

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ANNEXURE -3 (A)

VOLUME III I

SECTION-3/C

FOR ALL VERTICAL PUMPS EXCEPT ACW PUMP

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DATASHEET-A	VERTICAL CENTRIFUGAL PUMPS (GROUP A)
DATASHEET-A	VERTICAL CENTRIFUGAL PUMPS (GROUP B)

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1.0

GENERAL INFORMATION

1.1

This section presents the general guidelines and details of construction of vertical water service pumps to be provided under the scope. If Bidder proposes to install any other additional vertical water service pumps, the general guidelines as specified in the subsequent clauses of this section shall be strictly adhered to by the Bidder.

2.0

CODES AND STANDARDS

2.1

In addition to the requirements spelt out in Volume-II of this specification, the equipment to be provided under this section shall specifically conform to the following codes, standards, specifications and regulations, as applicable, including all the latest amendments as mentioned below.

2.1.1

IS-1710 : Vertical Turbine Pumps for Clear, Cold and Fresh Water.

2.1.2

IS-5120 : Technical requirements – Roto-dynamic special purpose pumps.

2.1.3

IS-5639 : Pumps for handling chemicals and corrosive liquids.

2.1.4

IS-5659 : Pumps for process water

2.1.5

IS-6536 : Pumps handling volatile liquids.

2.1.6

IS-9137 : Code for acceptance for centrifugal, mixed flow and axial flow pumps - Class `C'.

2.1.7

BS EN ISO 9906 : 2000 : Acceptance tests for Centrifugal, mixed flow and axial flow pumps - Class 'C' Tests.

2.1.8

BS EN ISO 9906 : 2000 : Acceptance tests for Centrifugal, mixed flow and axial flow pumps - Class 'B' Tests.

2.1.9

ANSI B 73.2 M : Vertical inline centrifugal pumps for chemical process.

2.1.10

API 610 : Centrifugal pumps for general refinery services

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2.1.11	Hydraulic Institute Standards of USA	
2.1.12	PTC 8.2 : Power Test Codes - Centrifugal pumps.	
2.1.13	Other accepted International Standards such as DIN/JIS/GOST etc which may be equivalent or superior to those specified above.	
2.2	In case of any contradiction between the above standards and this section and Datasheet-A attached to this section, the stipulations in the aforesaid section and Datasheet-A shall prevail and shall be binding on the Contractor.	
3.0	<u>SCOPE OF WORK</u>	
3.1	<u>SCOPE OF SUPPLY</u>	
3.1.1	The scope of supply under this section shall be as grouped and specified in Datasheet-A enclosed with this section. Items not specifically mentioned but deemed necessary by the Bidder for making the system completely reliable and efficient shall also be included.	
3.2	Three (3) Raw water supply pumps located in Raw water supply pump house for supplying water to cascade aerator common for both DM and Non DM complete with electric motor drives and all other accessories as specified in this section and in the datasheet-A attached herewith.	
3.3	Two (2) Ash water supply pumps located in Raw water supply pump house for supplying water to Ash Handling System makeup complete with electric motor drives and all other accessories as specified in this section and in the datasheet-A attached herewith.	
3.4	Two (2) Potable water supply pumps for plant water supply located in Filtered Water pump house for Non-DM complete with electric motor drives and all other accessories as specified in this section and in the datasheet-A attached herewith.	
3.5	Two (2) Potable water supply pumps for colony water supply located in Filtered Water pump house for Non-DM complete with electric motor	

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drives and all other accessories as specified in this section and in the datasheet-A attached herewith. 3.6 Two (2) Service water pumps for plant cleaning and washing located in Filtered Water pump house for Non-DM complete with electric motor drives and all other accessories as specified in this section and in the datasheet-A attached herewith. 3.7 Three (3) Cooling Tower make up pumps located in Filtered Water pump house for Non-DM complete with electric motor drives and all other accessories as specified in this section and in the datasheet-A attached herewith. 3.8 Two (2) Emergency make-up supply pumps located in Filtered Water pump house for Non-DM complete with electric motor drives and all other accessories as specified in this section and in the datasheet-A attached herewith. Three (3) Clear water Transfer pumps for AHP/Coal Handling Plant DS/Service water/ Horticulture supply located in Effluent Water pump house complete with electric motor drives and all other accessories as specified in this section and in the annexure attached herewith Each pump set for all the above groups shall be supplied with the following accessories, as applicable. (a) Heavy duty couplings of approved design to connect the pump shaft directly with the motor shaft. (b) Sets of base plates, support plates, grounding pads, thrust blocks, lifting lugs, eye bolts, nuts etc for each pump and motor set. (c) Slip on type drilled steel counter flanges of proper rating to suit the discharge flange of each pump set. All the counter flanges shall be complete with requisite number of bolts, nuts and gaskets etc. (d) Thrust pads, if required, for pump discharge head complete with all necessary fixing and bolting arrangement, fasteners etc.		

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	(e) One (1) pressure indicator with isolating cocks at the discharge side of each pump, two (2) additional stubs with isolating root valves for pressure tapings and two (2) thermowells for temperature tapings at the discharge side of each pump for performance testing. Thrust bearing shall be furnished with dial type thermometer, temperature switch for high temperature annunciation and oil level gauge. (f) All internal/integral piping with valves, fittings and instruments for lubrication, cooling and sealing, if applicable, shall be tapped off from respective pump discharge. (g) Pump of higher capacity using 3.3 KV drives motor shall be equipped with vibration measuring and temperature measuring probes for pump and motor bearing with adequate annunciation / interlock function.	
3.9	For detailed scope of services and works, Volume-II of this specification shall be referred to.	
4.0	<u>PERFORMANCE REQUIREMENTS</u>	
4.1	Performance requirements for all the pump(s) shall be as specified in datasheet-A enclosed with this section.	
4.2	Pump(s) shall preferably be designed to have the best efficiency at the specified duty point. Further, the pump(s) shall be suitable for continuous operation at any point within it's "range of operation" as specified in datasheet-A enclosed with this section.	
4.3	Pump(s) shall preferably have continuously rising head-capacity characteristics, with maximum head at pump discharge shut-off, to enable parallel operation	
	Under all circumstances, the `range of operation' of the pump(s) shall exclude any unstable operating zone of the head-capacity curve.	
4.4	In case the datasheet-A call for parallel operation of the pumps, pumps shall have identical characteristics to ensure equal load sharing and shall	

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ensure trouble-free operation of any pump when the other pump(s) working in parallel with it trip.		
5.0	<u>DESIGN AND CONSTRUCTION</u>	
	Pumps shall be of vertical shaft, complete with bowl, column pipe, discharge head and base plate with all accessories, as applicable. General design and constructional features of the pumps shall be as follows:	
5.1	<u>BOWL ASSEMBLY</u>	
5.1.1	This shall be either a single or multi-stage centrifugal, mixed flow or axial flow type with discharge co-axial with shaft. Type of impeller shall be chosen on the basis of the pump specific speed and the characteristics of the handling fluid.	
5.1.2	Pump(s) shall have provision for adjustment of impellers in vertical direction from an accessible location, preferably at the housing (where separate thrust bearing for the pump is provided). The adjustment mechanism must take into consideration the extension of the line shaft due to hydraulic down thrust, weight of the shaft and impeller.	
5.2	<u>DISCHARGE HEAD</u>	
5.2.1	Pump(s) shall be either above floor or below floor discharge type, as specified in the annexures, attached to this section.	
5.2.2	In case, expansion joint is to be used at the pump discharge, pump base plate shall either be adequately designed to take the unbalanced forces and moments from the use of such expansion joint or a separate thrust block at the pump discharge head shall be provided to transmit these forces to the external supporting structure. Calculation of thrust load shall be done considering the highest pressure seen by the pump and internal diameter of the arch of the expansion bellow.	

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5.3	<u>COLUMN PIPE</u>	
5.3.1	Column pipe shall be flanged and of bolted connection. Column pipes shall be designed for full internal vacuum.	
5.3.2	In case the datasheet-A ask for the pump with below floor discharge, and the water level is at or above the discharge valve level, the column pipe piece located at the intermediate floor level shall be provided with suitable floor sealing device.	
5.3.3	In case of multi-piece column pipe and shaft assembly, the design shall permit raising/lowering of the pump assembly piece by piece without any difficulty. Any fixtures, clamps etc necessary for such purpose shall be supplied by the Contractor. The Contractor shall also submit a write-up describing clearly the procedure of handling the pump.	
5.4	<u>IMPELLER SHAFT, LINE SHAFT AND HEAD SHAFT</u>	
5.4.1	Shaft size shall be selected on the basis of maximum torque to be applied on the pump shaft. Critical speed of the shaft shall be sufficiently away from the pump operating speed and in no case shall lie between 90% and 110% of the rated speed.	
5.4.2	Impeller shaft shall be guided by bearings provided in each bowl or above and below the impeller shaft assembly. The butting faces of the shaft shall be machined square to the assembly and the shaft shall be chamfered at the edges.	
5.4.3	Line shaft may be of single or multiple pieces as required. In case of multiple pieces, line shaft shall be coupled as per the standard practice of the manufacturer. For screwed coupling, screw directions shall permit tightening of the joint during pump operation.	

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5.4.4	Replaceable shaft sleeves shall be furnished at applicable locations, particularly under stuffing box and at other locations, as considered necessary.	
5.5	<u>SHAFT ENCLOSING TUBE</u> Shaft enclosing tube shall be required, unless self lubricated (and cooled) type of shaft bearings are asked for. Length of the shaft enclosing tube shall be in conformity with the shaft piece lengths.	
5.6	<u>SEAL RINGS</u> Replaceable seal/wear rings both on impeller and on casing shall be provided.	
5.7	<u>BEARINGS</u>	
5.7.1	Shaft Bearings Adequate number of properly designed bearings shall be provided for smooth and trouble-free operation of the pump. Number of bearings shall consider the number of shaft pieces used and the critical speed of the shaft. Bearings shall be either lubricated by external clear water/oil/grease or self lubricated as specified in the datasheet-A. In case of external water/oil lubrication, complete lubrication arrangement shall be furnished with the pump. Pre-lubrication tank and other accessories shall be within the scope of supply of the Bidder/Contractor, if required.	
5.7.2	Thrust Bearing Location of the thrust bearing may be at the pump body or at the driver or at both depending on the requirement of datasheet-A or as per the recommendation of the pump manufacturer (and approved by Owner). Thrust bearings shall be either grease or oil lubricated. Lubrication arrangement shall be such that the lubricant does not contaminate the handling fluid. The arrangement shall also be adequate to protect the	

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bearing, while the pump coast down to stop in case of power failure of the station. Pre-lubrication of the thrust bearing, if recommended by the pump manufacturer, shall be taken care of in designing the lubrication system. Cooling of the thrust bearing, if necessary, shall be done by the handling fluid/external water, depending on the fluid handled. Location of the thrust bearing may be at the pump body or at the driver, or at both depending on the requirement of datasheet-A or as per the recommendation of the pump manufacturer (and approved by Owner). 5.8 <u>REVERSE ROTATION</u> 5.8.1 The pump impeller and other rotating components shall be designed for reverse rotation, when subject to reverse flow at rated pump discharge head. 5.9 <u>DRIVE UNIT</u> 5.9.1 The pump shall be driven by electric motor. A heavy duty coupling shall be provided between the drive unit and the driven equipment (except for belt drive). 5.9.2 Unless otherwise specified, drive element power rating shall be the maximum of the following requirements. (a) 15% margin over the pump shaft input power at the rated working condition. (b) 5% margin over the maximum pump shaft input power required within its operating range including the shut off point. (c) Pump shaft input power required considering overloading of the pump assuming single pump operation in the event of tripping of the other pump(s) operating in parallel.		

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5.9.3	The drive equipment shall preferably be air cooled. In case the pumping fluid is water, free of abrasive and corrosive matter, the same can be used for cooling purpose.	
6.0	<u>DRAWINGS, DATA AND INFORMATION</u>	
6.1	For Drawing, Data and Information required along with BID refer Volume-VIII .	

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VERTICAL PUMPS (GROUP-A) DATASHEET-A			
SR.NO.	DESCRIPTION	GROUP-A	
1.0	Service	<-----Raw Water----->	
2.0	Designation	Raw Water Transfer Pump for DM and Non DM	Ash water make-up pumps
3.0	Duty	<----- Continuous ----->	
4.0	Location	<----- Indoor ----->	
5.0	Number of Pumps required	Three (3)	Two (2)
6.0	Number of Pumps working	Two (2)	One (1)
7.0	Number of Pumps Standby	One (1)	One (1)
8.0	Number of Pumps Working in parallel	Two (2)	---
9.0	Liquid handled	Raw Water	
10.0	Design Water Temperature	37°C (max)	37°C (max)
11.0	Motor pedestal floor elevation	Bidder to indicate based on specification guidelines	
12.0	Level of bottom of sump	Bidder to indicate based on specification guidelines	
13.0	Normal water level (M)	Bidder to indicate based on specification guidelines	
14.0	Minimum water level (M)	Bidder to indicate based on specification guidelines	
15.0	Maximum water level (M)	Bidder to indicate based on specification guidelines	

CONSULTANT : PROCON ENGINEERS

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SR.NO.	DESCRIPTION	GROUP-A
16.0	<u>PUMP PERFORMANCE REQUIREMENTS</u>	
16.1	Performance Standard	IS-1710/equivalent
16.2	Rated capacity, (m³/Hr.)	By bidder
16.3	Speed (RPM)	By Bidder
16.4	Estimated Total dynamic head at rated capacity (MLC)	By Bidder
16.5	Static head of pumping system (MLC)	DDE
16.6	Pump shut off head (MLC)	Bidder to indicate
16.7	Permissible tolerance in rated capacity (%)	± 2.5 percent at the rated head
16.8	Permissible tolerance in efficiency at rated capacity	No negative tolerance
16.9	Range of operation	Preferably between 70% to 130% of rated capacity
16.10	Suction specific speed	Should be within 9000 U.S UNITS
17.0	<u>DESIGN AND CONSTRUCTIONAL FEATURES</u>	
17.1	Design standard	IS-1710
17.2	Pump type	Non pull out, above Floor discharge
17.3	Impeller type	Closed
17.4	Reverse flow through pump to be considered for pump design	Yes

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SR.NO.	DESCRIPTION	GROUP-A	
17.5	Type of gland lubrication and sealing	By Bidder	
17.6	Location of thrust bearing	On pump and motor separately	
17.7	Thrust bearing to be designed for pump shut off	Yes	
17.8	Type of coupling	Flexible	
17.9	Bearing cooling	By Bidder	
17.10	Type of pump starting	Discharge valve closed/partly open. Bidder to furnish supporting documentation for review.	
18.0	<u>MATERIAL OF CONSTRUCTION</u>		
18.1	Casing	2% Ni-Cast Iron	
18.2	Column pipe	MS-as per IS-2062 (Min. 10 mm thick)	
18.3	Discharge elbow	MS-as per IS-2062 (Min. 10 mm thick)	
18.4	Impeller	ASTM-A-351 Gr. CF8	
18.5	Shaft sleeve	AISI-410 (Hardened)	
18.6	Shaft bearing	By Bidder	
18.7	Base plate	MS as per IS-2062	
18.8	Stuffing box	Cast Iron	
18.9	Line Shaft	Cast Iron	
18.10	Impeller shaft	AISI-410	
18.11	Shaft coupling	AISI-410 (Hardened)	

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SR.NO.	DESCRIPTION	GROUP-A	
18.12	Fasteners	SS-316	
18.13	Companion flange	MS as per IS-2062	
19.0	<u>SUPPLY OF ACCESSORIES AND SERVICES</u>		
19.1	Sole plate	Yes	
19.2	Foundation bolts, nuts, sleeves etc	Yes	
19.3	Discharge flanges with nuts, bolts and gaskets	Yes	
19.4	Gland Sealing / cooling and bearing cooling / lubrication system complete with pipes, valves, fittings and instruments as required	Yes	
19.5	Thrust Block	Yes, if applicable	
19.6	Pump motor Coupling and guard	Yes	
19.7	Eye bolts, lifting tackle etc	Yes	
19.8	Discharge pressure gauges with isolating cocks	Yes	
19.9	Instrument connections	Yes	
19.10	Vent with isolating cock	Yes	
19.11	All other accessories and services	Yes	
20.0	<u>INSPECTION AND TESTING</u>		

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SR.NO.	DESCRIPTION	GROUP-A	
20.1	Material testing of casing, impeller and shafts	Yes	
20.2	Hydrostatic testing	Yes	
20.3	Dynamic balancing test	Yes	
20.4	Sump model tests	Yes	
20.5	NDT Tests on casing/ shaft	Yes	
20.6	NDT Test on impeller	Yes	
20.7	Vibration And noise measurement	Yes	
20.8	Performance Tests	Yes	
20.9	Performance test to be done on	Proto type at rated speed	
20.10	Performance test required for determining	H Vs. Q curve P Vs. Q curve N Vs. Q curve NPSH Vs Q curve	
20.11	Field performance test required	No	
20.12	Other tests as per applicable clauses of this specification	Yes	

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<u>VERTICAL PUMPS (GROUP-B)</u> <u>DATASHEET-A</u>					
SR. NO.	Description	Group-B			
1.0	Service	<----Filtered water----->			
2.0	Designation	Service water Pump	Potable water pump for plant	Potable water pump for colony	Cooling Tower make up
3.0	Duty	<--Intermittent-->			<-----Continuous----->
4.0	Location	<-----Indoor ----->			
5.0	Number of Pumps required	Two (2)	Two (2)	Two (2)	Three (3)
6.0	Number of Pumps working	One (1)	One (1)	One (1)	One (2)
7.0	Number of Pumps Standby	One (1)	One (1)	One (1)	One (1)
8.0	Number of Pumps Working in parallel	---	---	---	Two (2)
9.0	Liquid handled	Filtered water from Non-DM			
10.0	Design Water Temperature	37 ⁰ C (max)			
11.0	Motor pedestal floor elevation	Bidder to indicate based on specification guidelines			

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SR. NO.	Description	Group-B	
12.0	Level of bottom of sump	Bidder to indicate based on specification guidelines	
13.0	Normal water level (M)	Bidder to indicate based on specification guidelines	
14.0	Minimum water level (M)	By Bidder	
15.0	Maximum water level (M)	By Bidder	
16.0	<u>PUMP PERFORMANCE REQUIREMENTS</u>		
(a)	Performance Standard	IS-1710/equivalent	
(b)	Rated capacity, (m ³ /Hr)	By bidder	
(c)	Speed, RPM	By Bidder	
(d)	Estimated Total dynamic head at rated capacity (MLC)	By Bidder	
(e)	Static head of pumping system (MLC)	DDE	
(f)	Pump shut off head (MLC)	Bidder to indicate	
(g)	Permissible tolerance in rated capacity (%)	± 2.5 percent at the rated head	

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SR. NO.	Description	Group-B	
(h)	Permissible tolerance in efficiency at rated capacity	No negative tolerance	
(i)	Range of operation	Normally between 70% to 130% of rated capacity	
(j)	Suction specific speed	Should be within 9000 U.S. UNITS	
17.0	<u>DESIGN AND CONSTRUCTIONAL FEATURES</u>		
(a)	Design standard	IS-1710	
(b)	Pump type	Non pull out, above Floor discharge	
(c)	Impeller type	Closed	
(d)	Reverse flow through pump to be considered for pump design	Yes	
(e)	Type of gland lubrication and sealing	Self Water	
(f)	Location of thrust bearing	On Pump	
(g)	Thrust bearing to be designed for pump shut off	Yes	

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SR. NO.	Description	Group-B	
(h)	Type of coupling	Flexible	
(i)	Bearing cooling	By Bidder	
18.0	<u>MATERIAL OF CONSTRUCTION</u>		
(a)	Casing	Cast Iron FG-260 as per IS-210	
(b)	Column pipe	MS-as per IS-2062 (Min. 10 mm thick)	
(c)	Discharge elbow	Do	
(d)	Impeller	ASTM-A-351 Gr. CF8	
(e)	Shaft sleeve	AISI-410 (Hardened)	
(f)	Shaft bearing	By Bidder	
(g)	Base plate	MS as per IS-2062	
(h)	Stuffing box	Cast Iron	
(i)	Line Shaft		
(j)	Impeller shaft	AISI-410	
(k)	Shaft coupling	AISI-410 (Hardened)	
(l)	Fasteners	SS-316	
(m)	Companion flange	MS as per IS-2062	
19.0	Supply of accessories and services		
(a)	Sole plate	Yes	
(b)	Foundation bolts,	Yes	

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SR. NO.	Description	Group-B	
	nuts, sleeves etc		
(c)	Discharge flanges with nuts, bolts and gaskets	Yes	
(d)	Gland Sealing / cooling and bearing cooling / lubrication system complete with pipes, valves, fittings and instruments as required	Yes	
(e)	Thrust Block	Yes, if applicable	
(f)	Pump motor Coupling and guard	Yes	
(g)	Eye bolts, lifting tackle etc	Yes	
(h)	Discharge pressure gauges with isolating cocks	Yes	
(i)	Instrument connections	Yes	
(j)	Vent with isolating cock	Yes	
(k)	All other accessories and	Yes	

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SR. NO.	Description	Group-B	
	services		
20.0	Inspection and Testing		
(a)	Material testing of casing, impeller and shafts	Yes	
(b)	Hydrostatic testing	Yes	
(c)	Dynamic balancing test	Yes	
(d)	Sump model tests	Yes	
(e)	NDT Tests on casing/ shaft	Yes	
(f)	NDT Test on impeller	Yes	
(g)	Vibration And noise measurement	Yes	
(h)	Performance Tests	Yes	
(i)	Performance test to be done on	Actual pump and motor	
(j)	Performance test required for determining	H Vs. Q curve P Vs. Q curve N Vs. Q curve NPSH Vs Q curve	
(k)	Field performance test required	No	

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SR. NO.	Description	Group-B	
(I)	Other tests as per applicable clauses of this specification	Yes	
	Note		
	1. The rated pump head shall be calculated by bidder considering the following parameters:		
	(a) Two pumps working at rated capacity and pumping water through one pipeline		
	2. The bidder shall calculate the actual heads based on the Plot Plan drawing, equipment location and size.		

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	ADDENDUM -III		
<u>DATASHEET-A</u>			
<u>VERTICAL PUMPS</u>			
INTAKE WATER BOOSTER PUMP			
SR.NO.	DESCRIPTION		
1.0	Service	From existing pump house (abandoned) to one (1) day reservoir.	
2.0	Orientation	vertical	
3.0	Duty	Continuous	
4.0	Location	Indoor	
5.0	Number of Pumps required	Three (3)	
6.0	Number of Pumps working	Two (2)	
7.0	Number of Pumps Standby	One (1)	
8.0	Liquid handled	Raw Water	
9.0	Motor pedestal floor elevation	Bidder to indicate based on specification guidelines	
10.0	Level of bottom of sump		
11.0	Normal water level (M)		
12.0	Minimum water level (M)		
13.0	Maximum water level (M)		
14.0	<u>PUMP PERFORMANCE REQUIREMENTS</u>		
(a)	Performance Standard	IS-1710/equivalent	
(b)	Rated capacity, (m³/Hr)	By bidder	
(c)	Speed (RPM)	By Bidder to be determined keeping in view the number of stages, acceptable head-capacity, power and NPSH values. (subject to Owner’s review)	

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	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		
	ADDENDUM -III		
SR.NO.	DESCRIPTION		
(d)	Estimated Total dynamic head at rated capacity (MLC)	By Bidder to be determined as follows: Static head: Elevation difference between minimum water level in the existing (abandoned) pump house plus 3 mWC residual pressure at the destination. Frictional head: 20 % margin on the calculated drop in the line based on Hazen Williams formula with a C factor of 120.	
(e)	Permissible tolerance in rated capacity (%)	± 2.5 percent at the rated head	
(f)	Permissible tolerance in efficiency at rated capacity	No negative tolerance	
15.0	<u>DESIGN AND CONSTRUCTIONAL FEATURES</u>	Please refer to Volume III-E2	
16.0	<u>MATERIAL OF CONSTRUCTION</u>		
17.0	<u>SUPPLY OF ACCESSORIES AND SERVICES</u>		
(a)	Sole plate	Yes	
(b)	Foundation bolts, nuts, sleeves etc	Yes	
(c)	Discharge flanges with nuts, bolts and gaskets	Yes	
(d)	Gland Sealing / cooling and bearing cooling / lubrication system complete with pipes, valves, fittings and instruments as required	Yes	

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	ADDENDUM -III		
SR.NO.	DESCRIPTION		
(e)	Thrust Block	Yes, if applicable	
(f)	Pump motor Coupling and guard	Yes	
(g)	Eye bolts, lifting tackle etc	Yes	
(h)	Discharge pressure gauges with isolating cocks	Yes	
(i)	Instrument connections	Yes	
(j)	Vent with isolating cock	Yes	
(k)	All other accessories and services	Yes	
18.0	<u>INSPECTION AND TESTING</u>		
(a)	Material testing of casing, impeller and shafts	Yes	
(b)	Hydrostatic testing	Yes	
(c)	Dynamic balancing test	Yes	
(d)	Sump model tests	Yes	
(e)	NDT Tests on casing/ shaft	Yes	
(f)	NDT Test on impeller	Yes	
(g)	Vibration and noise measurement	Yes	
(h)	Performance Tests	Yes	
(i)	Performance test to be done on	Proto type at rated speed	
(j)	Performance test required for determining	H Vs. Q curve P Vs. Q curve N Vs. Q curve NPSH Vs. Q curve	
(k)	Field performance test required	Yes	
(l)	Other tests as per applicable clauses of this specification	Yes	

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ANNEXURE 3 (B) VOLUME III-E2 SECTION – 3A VERTICAL PUMPS ACW PUMP		

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<u>CONTENT</u> <table><tr><td><u>CLAUSE NO.</u></td><td><u>DESCRIPTION</u></td></tr><tr><td>1.0</td><td>GENERAL INFORMATION</td></tr><tr><td>2.0</td><td>CODES AND STANDARDS</td></tr><tr><td>3.0</td><td>SCOPE OF WORKS</td></tr><tr><td>4.0</td><td>PERFORMANCE REQUIREMENTS</td></tr><tr><td>5.0</td><td>DESIGN AND CONSTRUCTION</td></tr><tr><td>6.0</td><td>DRAWING, DATA, CURVES AND INFORMATION</td></tr><tr><td>DATASHEET - A</td><td>VERTICAL PUMPS FOR ACW</td></tr></table>			<u>CLAUSE NO.</u>	<u>DESCRIPTION</u>	1.0	GENERAL INFORMATION	2.0	CODES AND STANDARDS	3.0	SCOPE OF WORKS	4.0	PERFORMANCE REQUIREMENTS	5.0	DESIGN AND CONSTRUCTION	6.0	DRAWING, DATA, CURVES AND INFORMATION	DATASHEET - A	VERTICAL PUMPS FOR ACW
<u>CLAUSE NO.</u>	<u>DESCRIPTION</u>																	
1.0	GENERAL INFORMATION																	
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DATASHEET - A	VERTICAL PUMPS FOR ACW																	

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	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 3A																											
REV: R0	MAIN & AUXILIARY COOLING WATER SYSTEMS	Page 49 of 113																											
1.0 <u>GENERAL INFORMATION</u> The general guidelines as illustrated in the subsequent clauses of this section shall be applicable for all vertical pumps to be installed by the Bidder. 2.0 <u>CODES AND STANDARDS</u> 2.1 In addition to the requirements spelt out in Volume II of this specification, the equipment to be provided under this section shall specifically conform to the following codes, standards, specifications and regulations, as applicable, including all the latest amendments subsequent to the year of publication as mentioned below. <table border="0"> <tr> <td style="vertical-align: top;">2.1.1</td> <td style="vertical-align: top;">IS 1710/1989</td> <td style="vertical-align: top;">: Vertical Turbine Mixed & Axial flow Pumps for Clear, Cold and Fresh Water.</td> </tr> <tr> <td style="vertical-align: top;">2.1.2</td> <td style="vertical-align: top;">IS 5120/1977</td> <td style="vertical-align: top;">: Technical requirements - Rotodynamic special purpose pumps.</td> </tr> <tr> <td style="vertical-align: top;">2.1.3</td> <td style="vertical-align: top;">IS 5639/1970</td> <td style="vertical-align: top;">: Pumps for handling chemicals and corrosive liquids.</td> </tr> <tr> <td style="vertical-align: top;">2.1.4</td> <td style="vertical-align: top;">AWWAE 101 (ANSI B58-1)</td> <td style="vertical-align: top;">: Vertical Turbine Pumps – Line Shaft and Submersible Types.</td> </tr> <tr> <td style="vertical-align: top;">2.1.5</td> <td style="vertical-align: top;">IS 5659/1970</td> <td style="vertical-align: top;">: Pumps for process water</td> </tr> <tr> <td style="vertical-align: top;">2.1.6</td> <td style="vertical-align: top;">IS 6536/1972</td> <td style="vertical-align: top;">: Pumps for handling volatile liquids.</td> </tr> <tr> <td style="vertical-align: top;">2.1.7</td> <td style="vertical-align: top;">IS 9137/1978</td> <td style="vertical-align: top;">: Code for acceptance for centrifugal, mixed flow and axial flow pumps - Class 'C'.</td> </tr> <tr> <td style="vertical-align: top;">2.1.8</td> <td style="vertical-align: top;">BS EN ISO 9906: 2000</td> <td style="vertical-align: top;">: Acceptance tests for Centrifugal, mixed flow and axial flow pumps – Class 'B' & 'C' Tests</td> </tr> <tr> <td style="vertical-align: top;">2.1.9</td> <td style="vertical-align: top;">ANSI B 73.2M/ 1984</td> <td style="vertical-align: top;">: Vertical inline centrifugal pumps for chemical process.</td> </tr> </table>			2.1.1	IS 1710/1989	: Vertical Turbine Mixed & Axial flow Pumps for Clear, Cold and Fresh Water.	2.1.2	IS 5120/1977	: Technical requirements - Rotodynamic special purpose pumps.	2.1.3	IS 5639/1970	: Pumps for handling chemicals and corrosive liquids.	2.1.4	AWWAE 101 (ANSI B58-1)	: Vertical Turbine Pumps – Line Shaft and Submersible Types.	2.1.5	IS 5659/1970	: Pumps for process water	2.1.6	IS 6536/1972	: Pumps for handling volatile liquids.	2.1.7	IS 9137/1978	: Code for acceptance for centrifugal, mixed flow and axial flow pumps - Class 'C'.	2.1.8	BS EN ISO 9906: 2000	: Acceptance tests for Centrifugal, mixed flow and axial flow pumps – Class 'B' & 'C' Tests	2.1.9	ANSI B 73.2M/ 1984	: Vertical inline centrifugal pumps for chemical process.
2.1.1	IS 1710/1989	: Vertical Turbine Mixed & Axial flow Pumps for Clear, Cold and Fresh Water.																											
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2.1.10	API 610/1989 : Centrifugal pumps for general refinery services.	
2.1.11	Hydraulic Institute Standards of USA (1983)	
2.1.12	PTC 8.2/1965 : Power Test Codes - Centrifugal pumps	
2.1.13	Other accepted Standards like DIN/JIS/GOST etc, which may be equivalent or superior to those specified above.	
2.1.14	In case of any contradiction between the above standards and Datasheet - A attached to this section, the stipulations in the Datasheet - A shall prevail and shall be binding on the Contractor.	
3.0	<u>SCOPE OF WORKS</u>	
3.1	<u>SCOPE OF SUPPLY</u>	
3.1.1	The scope of supply under this section and pertaining to 1 x 660 MW Unit shall be as below. Items not specifically mentioned but deemed necessary by the Bidder for making the system completely reliable and efficient shall also be included.	
	(a) Equipments	
	(i) ACW Pumps : Two (2) (One working + One Standby) Vertical Wet Pit type Auxiliary Cooling Water (ACW) Pumps complete with electric motor drives together with all other accessories as specified and corresponding to the ratings obtained in strict conformance with the guidelines specified.	
	(ii) Any other vertical pump to be installed by the Contractor.	
	(b) Equipment Accessories	
	Each pump set for all the above groups shall be supplied with the following accessories, as applicable.	

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(i) Heavy-duty couplings of approved design to connect the pump shaft directly with the motor shaft. (ii) Sets of base plates, support plates, grounding pads, thrust blocks, fitting lugs, eyebolts, nuts etc for each pump and motor set. (iii) Slip on type drilled steel counter flanges of proper rating to suit the discharge flange of each pump set. All the counter flanges shall be complete with requisite number of bolts, gaskets etc. (iv) Thrust pads, if required, for pump discharge head complete with all necessary fixing and bolting arrangement, fasteners etc. (v) One (1) pressure indicator with isolating cocks at the discharge side of each pump; Two (2) additional stubs with isolating root valves for pressure tapings and Two (2) thermo wells for temperature tapings at the discharge side of each pump for performance testing. Thrust bearing shall be furnished with dial type thermometer, temperature switch for high temperature annunciation and oil level gauge. (vi) All internal/integral piping with valves, fittings and instruments for lubrication, cooling and sealing, if applicable, shall be tapped off from respective pump discharge. 3.2 For detailed scope of services and works, Volume II of this specification shall be referred to. 4.0 <u>PERFORMANCE REQUIREMENTS</u> 4.1 Performance requirements for the pumps shall be as specified in Datasheet – A. 4.2 Pumps shall preferably be designed to have the best efficiency at the specified duty point. Further, the pumps shall be suitable for continuous operation at any point within its `range of operation.		

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4.3 4.4 4.5 5.0 5.1 5.1.1 5.1.2	Pumps shall preferably have continuously rising head-capacity characteristics, with maximum head at pump discharge shut-off, to enable parallel operation. Power capacity characteristics shall preferably be non-overloading type. Under all circumstances, the 'range of operation' of the pumps shall exclude any unstable operating zone of the head-capacity curve. For parallel operation of the pumps, pump shall have identical characteristics to ensure equal load sharing and shall ensure trouble-free operation of any pump when the other pumps, working in parallel with it trips. The pump and motor shall be designed to withstand run away speed attained with reverse rotation caused by reverse flow continuously in case the device provided to prevent the reverse rotation fails. <u>DESIGN AND CONSTRUCTION</u> Pumps shall be of vertical shaft, complete with bowl, column pipe, discharge head and base plate with all accessories. General design and constructional features of the pumps shall be as follows: <u>BOWL ASSEMBLY</u> This shall be either a single or multi-stage centrifugal, mixed flow or axial flow type with discharge co-axial with shaft. Type of impeller shall be chosen on the basis of the pump specific speed and the characteristics of handling fluid. Pumps shall have provision for adjustment of impellers in vertical direction from an accessible location, preferably at the housing (where separate thrust bearing for the pump is provided). The adjustment mechanism must take into consideration the extension of the line shaft due to hydraulic down thrust, weight of the shaft and impeller.	

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5.2	<u>DISCHARGE HEAD</u> In case, expansion joint is to be used at the pump discharge, pump base plate shall either be adequately designed to take the unbalanced forces and moments from the use of such expansion joint or a separate thrust block at the pump discharge head shall be provided to transmit these forces to the external supporting structure. Calculation of thrust load shall be done considering the highest pressure seen by the pump and internal diameter of the arch of the expansion bellow. 5.3 <u>COLUMN PIPE</u> 5.3.1 Column pipe shall be flanged have bolted connection and shall be designed for full internal vacuum. 5.3.2 In case pump discharge, is below the floor level and the water level is at or above the discharge valve level, the column pipe piece located at the intermediate floor level shall be provided with suitable floor sealing device. 5.3.3 In case of multi-piece column pipe and shaft assembly, the design shall permit raising/lowering of the pump assembly piece by piece without any difficulty. Any fixtures, clamps etc necessary for such purpose shall be supplied by the Contractor under this section. The Contractor shall also submit a write-up describing clearly the procedure of handling the pump. 5.4 <u>IMPELLER SHAFT, LINE SHAFT AND HEAD SHAFT</u> 5.4.1 Shaft size shall be selected on the basis of maximum torque to be applied on the pump shaft. 5.4.2 Critical speed of the shaft shall be sufficiently away from the pump operating speed and in no case shall lie between 90% and 110% of the rated speed. 5.4.3 Impeller shaft shall be guided by bearings provided in each bowl or above and below the impeller shaft assembly. The butting faces of the shaft shall be machined square to the assembly and the shaft shall be chamfered at the edges.	

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designed to permit removal of entire pump along with discharge head and base plate without disturbing the sole plate or grout. The sole plate shall be blast cleaned to a clear white finish. Base plate and pump supports shall be so constructed and the pumping unit so mounted as to minimise misalignment and withstand hydraulic thrust. Pump foundation base plate shall be stress relieved and machined after welding. 80% blue matching for contact surface shall be provided by the pump manufacturer/bidder between pump sole/foundation plate and bottom surface of motor skirt flange. Similarly, 80% blue matching for contact surface shall be ensured by the bidder between top surface of flange of motor skirt and bottom surface of motor flange. All metal to metal contact surfaces for pump shall be provided with 80% blue matching prior to offering the equipment for inspection & testing. 5.9 <u>BEARINGS</u> 5.9.1 Shaft Bearings Adequate number of properly designed bearings shall be provided for smooth and trouble-free operation of the pump. Number of bearings shall consider the number of shaft pieces used and the critical speed of the shaft. Bearings shall be either lubricated by external clear water/oil/grease or self lubricated as specified in the Datasheet - A. In case of external water/oil lubrication, complete lubrication arrangement shall be furnished with the pump. Pre-lubrication of the shaft bearings, pre-lubrication tank and other accessories shall be within the scope of supply of the Bidder/Contractor. 5.9.2 Thrust Bearing Thrust bearing of adequate size and capacity shall be provided to take the vertical thrust of the impeller arising out of the pump operation and dead weight of the rotating components. Life of the thrust bearing shall be guided by the design standard of the pump. Thrust bearing shall be capable of running continuously at maximum load.		

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Thrust bearings shall be either grease or oil lubricated. Lubrication arrangement shall be such that the lubricant does not contaminate the handling fluid. The arrangement shall also be adequate to protect the bearing, while the pump coast down to stop in case of power failure of the station. Pre-lubrication of the thrust bearing, if recommended by the pump manufacturer, shall be taken care of in designing the lubrication system. Cooling of the thrust bearing, if necessary, shall be done by the handling fluid/external water. Location of the thrust bearing may be at the pump body or at the driver, or at both depending on the requirement of Datasheet - A or as per the recommendation of the pump manufacturer (and approved by Owner). 5.10 <u>REVERSE ROTATION</u> 5.10.1 The pump impeller and other rotating components shall be designed for reverse rotation, when subject to reverse flow at rated pump discharge head. 5.11 <u>DRIVE UNIT</u> 5.11.1 The pump shall be driven by electric motor. A heavy duty coupling shall be provided between the drive unit and the driven equipment (except for belt drive). 5.11.2 Unless otherwise specified in Datasheet - A, drive element power rating shall be the maximum of the following requirements. (a) 10% margin over the pump shaft input power at the rated working condition. (b) 5% margin over the maximum pump shaft input power required within its operating range including the shut off point. (c) Pump shaft input power required considering overloading of the pump assuming single pump operation in the event of tripping of the other pump(s) operating in parallel.		

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	(d) Shaft input power required to bring the pump to its rated condition (or any point in its working range) while the pump is in reverse rotation due to reverse flow of the fluid at rated head with the discharge butterfly valve partially open as per the start-up logic and the other adjoining pump running. 5.11.3 The drive equipment shall preferably be air-cooled. In case the pumping fluid is water, free of abrasive and corrosive matter, the same can be used for cooling purpose. The arrangement shall be within the scope of the supplier. 6.0 <u>DRAWINGS, DATA, CURVES AND INFORMATION</u> Please refer Volume VIII A.	

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<u>DATASHEET – A</u> <u>VERTICAL PUMPS</u> <u>(AC W Pumps)</u>		
SR. NO.	DESCRIPTION	ACW PUMPS
1.0	Service	Auxiliary Cooling Water System
2.0	Designation	A C W Pumps
3.0	Duty	Continuous
4.0	Location	Indoor
5.0	Number of Pumps required	2 x 100%
6.0	Number of Pumps working	One (1)
7.0	Number of Pumps standby	One (1)
8.0	Number of Pumps working parallel	Not applicable
9.0	Liquid handled	Cooling water
10.0	Temperature	33°C (design)
11.0	Motor pedestal floor elevation	Bidder to indicate
12.0	Level of bottom of sump	Bidder to indicate
13.0	Normal water level (M)	Bidder to indicate as per guidelines in Section-I of this volume.
14.0	Minimum water level (M)	Bidder to indicate as per guidelines in Section-I of this volume.
15.0	Maximum water level (M)	Bidder to indicate as per guidelines in Section-I of this volume.

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SR. NO.	DESCRIPTION	ACW PUMPS
16.0	<u>PUMP PERFORMANCE REQUIREMENT</u>	
16.1	Performance standard	IS-1710 / HIS
16.2	Rated capacity (m ³ /hr)	Bidder to estimate based on criteria specified.
16.3	Running Speed	Shall be selected trading amongst operation range, NPSH margins & efficiency
16.4	Total dynamic head at rated capacity (MLC)	Bidder to indicate as per guidelines in Section-I of this volume.
16.5	Static head of pumping system (MLC)	Bidder to indicate as per guidelines in Section-I of this volume.
16.6	Pump shut off head (MLC)	Bidder to indicate as per guidelines in Section-I of this volume.
16.7	Permissible tolerance in rated capacity (%)	± 2.5 % at rated head.
16.8	Permissible tolerance in efficiency at rated capacity	No negative tolerance.
16.9	Range of operation	Bidder to indicate.
16.10	Suction specific speed	Shall be limited to 9000 US units.
16.11	Noise level	For details refer Volume-II, Section-IV.
17.0	<u>DESIGN AND CONSTRUCTIONAL FEATURES</u>	
17.1	Design Standard	IS-1710/ Equivalent standard

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SR. NO.	DESCRIPTION	ACW PUMPS
17.2	Pump type	Below floor discharge
17.3	Impeller type	Closed
17.4	Reverse flow through pump to be considered for pump design	Yes
17.5	Head at reverse flow	Bidder to indicate
17.6	Type of gland lubrication and sealing	By self water
17.7	Location of thrust bearing	Separate for pump and motor
17.8	Thrust bearing to be designed for pump shut off operation	Yes
17.9	Type of coupling	Flexible
17.10	Gland lubrication and sealing	By Self water
17.11	Bearing cooling	By Self water
18.0	<u>MATERIAL OF CONSTRUCTION</u>	
18.1	Casing	2% Ni-C.I.
18.2	Column pipe	IS-2062 (MS) (Minimum 10 mm thick)
18.3	Discharge elbow	IS-2062 (MS) (Minimum 10 mm thick)
18.4	Impeller Bowl	ASTM-A-351 Gr.CF8M
18.5	Shaft sleeve	AISI-410 (Hardened)
18.6	Shaft bearing	Cutless Rubber
18.7	Base plate	IS-2062
18.8	Stuffing box	C.I.

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SR. NO.	DESCRIPTION	ACW PUMPS
18.9	Line shaft	AISI-410
18.10	Impeller shaft	AISI-410
18.11	Shaft coupling	AISI-410 (Hardened)
18.12	Fasteners	SS-316
18.13	Companion flange	IS-2062
19.0	<u>SUPPLY OF ACCESSORIES AND SERVICES</u>	
19.1	Sole plate	Yes
19.2	Foundations bolts, nuts, sleeves etc.	Yes
19.3	Discharge flanges with nuts, bolts and gaskets.	Yes
19.4	Gland sealing/cooling and bearing cooling/lubrication system complete with pipes, valves, fittings and instruments as required.	Yes
19.5	Suction strainers	No
19.6	Prelubrication tank and accessories	No
19.7	Thrust block	Yes, if applicable
19.8	Pump motor coupling and guard	Yes
19.9	Eye bolts, lifting tackle etc.	Yes
19.10	Discharge pressure gauge with isolating cock	Yes
19.11	Instrument connections	Yes

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SR. NO.	DESCRIPTION	ACW PUMPS	
19.12	Vent with isolating cock	Yes	
19.13	All other accessories & services	Yes	
20.0	<u>PERFORMANCE TESTS</u>		
20.1	Performance Tests	Yes	
20.2	Performance test to be done on	Proto type at full speed	
20.3	Performance test required for determining	Head Vs capacity, BHP Vs capacity, Efficiency Vs capacity, submergence Vs capacity curves	
20.4	Field performance test required	Yes	
20.5	Other tests as per applicable clauses of this specification	Yes	

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ANNEXURE I **MINIMUM TESTING AND INSPECTION REQUIREMENTS**

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1.0 GENERAL:

- 1.1 An indicative list of Inspection and testing requirements for each package has been given for various equipments across various volumes of this specification. Bidder shall note that these testing and inspections listed herein are the minimum requirements as perceived by the Owner; the bidder shall consider this only as a general guidance and is not meant to be exhaustive. The bidder shall consider requisite testing and inspections across the equipments/systems forming the proposed power plant unit based on his own experience and in line with the current industry practices for identically rated power plant for the technology under consideration and relevant codes and standards. The comprehensive list of tests considered for each of the equipment/ systems shall be furnished as part of the bid

2.0 ~~PUMPS, STRAINERS & FILTERS FOR GENERAL SERVICE, ACW & DMCW~~

- 2.1 Centrifugal Pumps (Horizontal/Vertical), Sump Pump, Vertical Turbine Pumps, Submersible Pumps:
- The Manufacturer shall conduct all tests required to ensure that the equipment furnished conforms to the requirements of Technical specifications. All materials shall be of tested quality. No weld repair on Cast Iron is allowed.
- Following minimum NDT shall be carried out:
- UT on Shaft in proof machined condition for Dia 50 mm or above.
 - MPI/DPT on machined surface of Casing, Shaft, Impeller and on Welds of fabricated parts.
 - All rotating components shall be subjected to Static/Dynamic Balancing to ISO 1940 Gr.6.3. Any change in balancing grade shall be subject to owner's approval

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- All pressure retaining parts (e.g. Casing, Bowl Assembly, Discharge Head, Column Pipes etc.) shall be Hydrostatically tested at 200% of Pump Rated Head or at 150% of Shut-off head, whichever is higher, for at least 30 minutes. No leakage or pressure drop is allowed. 2.2 <u>PERFORMANCE TEST</u> All pumps shall be tested at shop at rated speed for Head, Capacity, Efficiency and Power consumption. Pump shall be given running test for the entire operating range i.e. from Shut-off head to Maximum flow for at least 1 (one) hour. A sufficient number of readings shall be taken to plot the curve, with one point at Design flow. Testing standard shall be HIS (Hydraulic Institute Standard) of USA or equivalent acceptable to Owner. Noise and Vibration readings shall be taken at shop for reference and shall meet the guaranteed value as per Technical Specifications at site. Only those pumps shall be subjected to Strip Down test, to visually check for mechanical damages, where abnormal noise or excessive vibrations are observed during the Performance test. NPSH test shall be conducted with water as the medium.		

ANNEXURE 3(C)
PAINTING DETAILS FOR ALL VERTICAL PUMPS

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openings shall be closed with forged steel plugs. The closures shall be taped to seal the interior of the equipment. Open ends of piping, tubing and conduit shall be sealed and taped. Returnable containers and special shipping devices shall be returned by the manufacturer's field representative at the Contractor's expense.		
15.0	<u>PAINTING</u>	
15.1	<u>GENERAL</u>	
All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. Surfaces not easily accessible after shop assembly shall be treated before-hand and protected for life of the equipment. Surfaces to be finish painted after installation shall be shop painted with at least two (2) coats of primer. Steel surfaces, which are not to be painted, shall be coated with suitable rust preventive compound subject to the approval of the Owner. All paints shall be used in accordance with the manufacturer's instructions. No thinners or other substance shall be added to the coating material without the approval of the Engineer. The quality and vendor of the paints shall require approval of the Owner. All paints, when applied in a normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects. All primers shall be well marked into the surface, particularly in areas where pitting is evident, and the first priming coat shall be applied as soon as possible after cleaning, within four hours maximum. The paint shall be applied by brush, roller or airless spray, according to the manufacturer's instructions. Spray painting shall be carried out by operators trained and thoroughly experienced in the use of the equipment. If the drying interval between successive coats, which should not exceed one week, has been so long as to endanger the adhesion of the following coat, the paint already applied shall be lightly rubbed down with fine abrasive paper before putting on the next coat. Paint spraying on large surfaces shall not normally be done indoors, except with the approval of the Engineer. Spray guns shall not be used outdoors in		

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windy weather or near unprotected surfaces of a contrasting colour and under no circumstances shall spray guns be used where spray may be carried into or onto exposed electrical equipment. Paint containers shall not be opened until required and the paint shall be mechanically mixed thoroughly before use, and agitated occasionally during use. Electrical equipment shall be shop finished with one or more coats of primer and two coats of high-grade oil resistant enamel. The interior of all panels' cabinets and enclosures shall be finished with gloss white enamel. The Contractor shall furnish sufficient touch-up paint for one complete finish coat on all exterior factory surfaces of each item of equipment. The touch-up paint shall be of the same type and colour as the factory applied paint and shall be carefully packed to avoid damage during shipment. Complete painting instructions shall be furnished. The Contractor shall select shop primer for steel and iron surfaces, which will have a continuous operating temperature below 35°C, in accordance to the relevant standard. Special high temperature primer shall be used on surface exposed to operating temperature above 35°C. The Owner/Engineer shall submit the colour scheme during execution of contract for approval.		
15.2	<u>PREPARATION</u> Oil and grease shall be removed from the surface by washing with a suitable detergent, rinsing with clean water, and drying. Surfaces to be shot blasted shall be cleaned to Swedish Standard SA 2.5 or equivalent, and all dust remaining after cleaning shall be removed. The priming coat shall be applied without delay.	
15.3	<u>DAMAGED PAINTWORK</u> Any damaged paintwork shall be made good as follows:	

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15.3.1	The damaged area, together with an area extending 25 mm around its boundary, shall be cleaned down to bare metal.	
15.3.2	A priming coat shall be immediately applied, followed by a full paint finish equal to that originally applied and extending 50 mm around the perimeter of the original damage.	
15.3.3	The repainted surface shall present a smooth surface. This shall be obtained by carefully chamfering the paint edges before and after priming	
15.4	<u>PAINTING SYSTEMS</u> The requirements for the Dry Film Thickness (DFT) of paint and the materials to be used shall be as stated below, unless otherwise specified elsewhere in this specification.	
15.4.1	Surfaces subject to Weathering All surfaces shall have a minimum of four coats of paint made up as follows: (a) Primer coat : 35 micron DFT (b) Tie coat : 35 micron DFT (c) Finishing coat (Two Nos.) : 35 micron DFT per coat (d) The total minimum DFT : 140 micron	
15.4.2	Surfaces Inside Buildings All surfaces shall have a minimum of three coats of paint made up as follows: (a) Primer coat : 35 micron DFT (b) Tie coat : 35 micron DFT (c) Finishing coat (Two Nos.) : 25 micron DFT per coat (d) The total minimum DFT : 120 micron	

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The Contractor shall select the type and colour of primer & finish coat after approval by the Owner.

For detail painting on building & structural steel elements, please refer **Volume VI / A & B** of this specification.

16.0 COLOUR CO-ORDINATION & FINISH

16.1 Exterior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and with the surrounding landscape.

16.2 Interior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and which will be conducive to; the comfort, well-being and high productivity of the operators. Operating plant and services provided shall be colour coded for ease of identification.

16.3 All finishes shall be durable and as far as possible maintenance free. Finishes shall be easily cleaned.

16.4 Final colours and finishes shall be to the Approval of the Engineer.

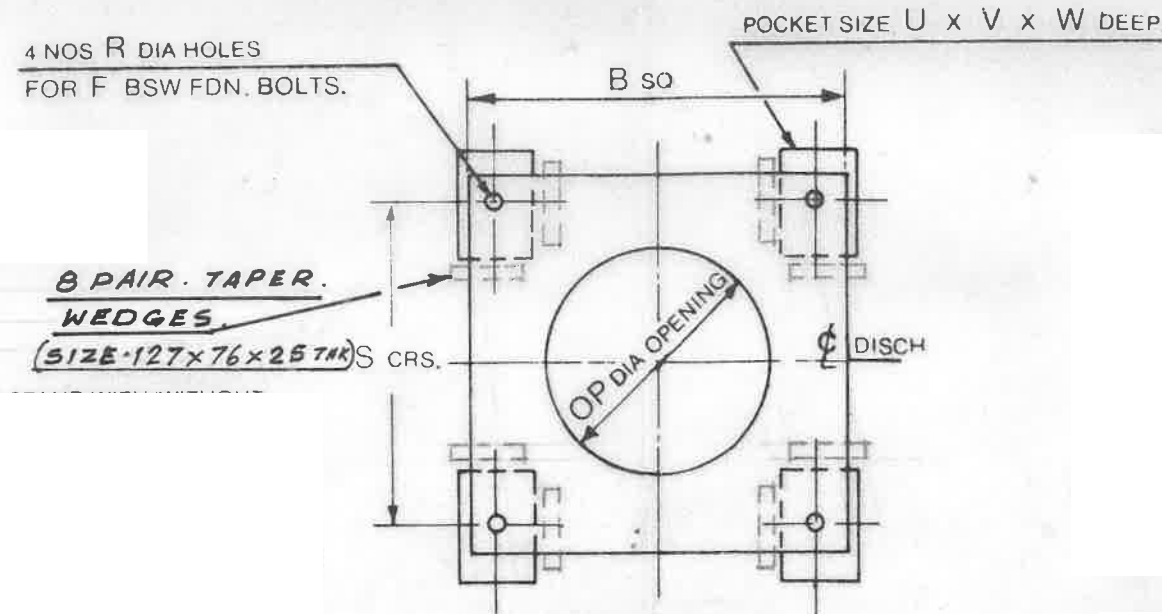
17.0 ENVIRONMENT PROTECTION AND NOISE LEVEL REQUIREMENT

17.1 ENVIRONMENT PROTECTION

The plant shall be designed for installation and operation in harmony with the surrounding environment and all measures of pollution control shall be ensured by the Bidder to restrict pollution from the liquid effluent and Stack emission within the limits as given below with due consideration of Environment (Protection) Rules 1986 as amended till date.

In case the Ministry of Environment & Forest stipulates any other conditions not specified hereunder while clearing the project, same shall be complied with by the Contractor.

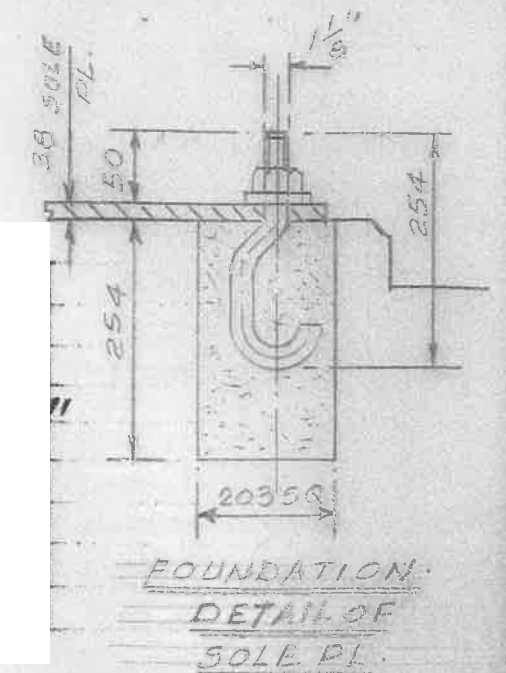
ANNEXURE-5 FOR FOUNDATION DETAILS FOR INTAKE WATER BOOSTER PUMP



PLAN OF SOLE PLATE

DIMENSIONS:

ML	938	
TL	727	
A	1067	
D ₁	38	
D ₂	32	
C	406	
M	686	
CL	3962	
BL	978	
G	954	
SL	610	
BD	762	
S	965	
B	1067	
R	32	
F	1 1/8" B.S.W.	
H	1200	
U x V x W	203 x 203 x 254	
SD	5800	
OP	864	
K	5000	





TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-415-100-N011**

SECTION: **I**

SUB-SECTION: **IB**

REV. NO. **00** DATE 10.12.2019

SHEET **1** OF **1**

SUB-SECTION – IB

SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)



TITLE:

ELECTRICAL EQUIPMENT SPECIFICATION
FOR
MISC PUMPS

SPECIFICATION NO.

SECTION: **C**REV NO. : **00** DATE: 21/08/2019

SHEET: 1 OF 2

SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER/ PURCHASER

- a) Services and equipment as per "Electrical Scope between BHEL and Vendor".
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Electrical load requirement for MISC. PUMPS
- e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL.
- g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
- h) Motor shall meet minimum requirement of motor specification.
- i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- j) Cable BOQ worked out based on routing of cable listing provided by the vendor for "both end equipment in vendor's scope" shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.
- k) Technical requirements shall be as per specifications listed in Clause 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7 & 4.8 below.

2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:

Refer "Electrical Scope between BHEL and Vendor".

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

- 3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate.
- 3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.



TITLE:

ELECTRICAL EQUIPMENT SPECIFICATION
FOR
MISC PUMPS

SPECIFICATION NO.

SECTION: **C**

REV NO. : **00** DATE: 21/08/2019

SHEET: 2 OF 2

4.0 LIST OF ENCLOSURES

- 4.1 Electrical scope between BHEL & vendor (Annexure-A).
- 4.2 Technical specification for Motors DG/BSL U-6/2011/T-1
- 4.3 Data Sheet- A along with Annexure-I.
- 4.4 Load data format (Annexure-B).
- 4.5 Explanatory notes for cable routing
- 4.6 Quality Plan

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR(FOR EPC PROJECTS)

PACKAGE: MISC. PUMP (Supply Package)

PROJECT: 1X660MW BHUSAVAL THERMAL POWER STATION, UNIT-6

<u>S.NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1	415 V MCC	BHEL	BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motors.
3	Power cables, control cables and screened control cables	BHEL	BHEL	Incoming cable from BHEL supplied MCC will be informed by BHEL. Screened control cable between DCS & field equipment will also be informed by BHEL. Vendor shall provide lugs & glands accordingly.
4	Cable trays, accessories & cable trays supporting system	BHEL	BHEL	
5	Cable glands and lugs for equipments supplied by Vendor	Vendor	BHEL	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power and control cables.
6	Conduit and conduit accessories for cabling between equipments supplied by vendor	BHEL	BHEL	
7	Equipment grounding & lightning protection	BHEL	BHEL	
8	Below grade grounding	BHEL	BHEL	
9	LT Motors with base plate and foundation hardware	Vendor	BHEL	Makes shall be subject to BHEL approval at contract stage.
10	Mandatory spares	Vendor	-	Vendor to quote as per specification.
11	Recommended O & M spares	Vendor	-	As per specification
12	Any other equipment/material/service required for completeness of system but not specified above (to ensure trouble free and efficient operation of the system).	Vendor	BHEL	
13	Electrical equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

1. Make of all electrical equipments/items supplied shall be reputed make & shall be subject to approval of BHEL after award of contract.
2. All QPs shall be subject to approval of BHEL after award of contract without any commercial implication.

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1.0 <u>SCOPE</u> 1.1 This section covers the general requirements of the drive motors for power station auxiliary equipment. 1.2 Motors shall be furnished in accordance with both this general specification and the accompanying driven equipment specification. 1.3 In case of any discrepancy, the driven equipment specification shall govern etc. 2.0 <u>STANDARDS</u> 2.1 All motors shall conform to the latest applicable IS, IEC and CBIP Standards/ Publications except when otherwise stated herein or in the driven equipment specification. 2.2 Major standards, which shall be followed, are listed below other applicable Indian Standards for any component part even if not covered in the listed standards shall also be followed (a) IS-325 (b) IS-12615 (c) IEC-34 3.0 <u>SERVICE CONDITIONS</u> 3.1 The motors will be installed in hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash canopy to be provided to all outdoor install motors. 3.2 Unless otherwise noted, electrical equipment/system design shall be based on the service conditions and auxiliary power supply given in the annexure to this specification.		

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3.3	For motor installed outdoor and exposed to direct sunrays, the effect of solar heat shall be considered in the determination of the design ambient temperature	
4.0	<u>TYPE AND RATING</u>	
4.1	<u>A.C. MOTORS</u>	
4.1.1	Motors shall be general purpose, constant speed, squirrel cage, three phase, induction type.	
4.1.2	All motors shall be rated for continuous duty. They shall also be suitable for long period of inactivity.	
4.1.3	The motor name-plate rating at 50°C shall have at least 10% margin over the input power requirement of the driven HT equipment at rated duty point unless stated otherwise in driven equipment specification or in general electrical specification.	
4.1.4	The motor characteristics shall match the requirements of the driven equipment so that adequate starting, accelerating, pull up, break down and full load torques are available for the intended service.	
4.1.5	All LT motors used in this project are proposed to be energy efficient type suitable for EFF1 efficiency rating.	
4.1.6	The motor name plate rating shall have at least 10% margin over the input power requirement of the HT driven equipment and 15% for LT driven equipments at rated duty point.	
4.1.7	Motors located in hazardous area shall be flame proof type.	
4.2	<u>D.C. MOTORS</u>	
4.2.1	D.C. Motor provided for emergency service shall be shunt/compound wound type.	
4.2.2	Motor shall be sized for operation with fixed resistance starter for maximum reliability.	

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4.2.3	Starter panel complete with all accessories shall be included in the scope of supply.	
4.3	For equipment installed outdoor and exposed to direct sun rays, the effect of solar heat shall be considered in determining the design ambient temperature.	
5.0	<u>PERFORMANCE</u>	
5.1	<u>RUNNING REQUIREMENTS</u>	
5.1.1	Motor shall run continuously at rated output over the entire range of voltage and frequency variations as given in the annexure.	
5.1.2	The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals.	
5.1.3	The motor shall be designed to withstand momentary overload of 60% of full load torque for 15 second without any damage.	
5.1.4	Motor shall not be stalled if the supply voltage drops to 70% of the rated voltage for 2 seconds duration.	
5.2	<u>STARTING REQUIREMENTS</u>	
	Motor shall be designed for direct online starting at full voltage. Starting current shall not exceed 6 times full load current for all auxiliaries except boiler feed pump where the starting current shall be limited to 4.5 times. No further tolerances are applicable on starting current specified above for HT motors	
5.2.1	The motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage	
5.2.2	Motor shall start with rated load and accelerate to full speed with 80% rated voltage at motor terminal except BFP motor. In case of BFP motor, it shall	

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be 75% rated voltage. Minimum starting requirement for mill motor (double cage) shall be 85% rated voltage at motor terminals.		
5.2.3	Motor shall be capable of three equally spread starts per hour, two starts in quick succession from cold condition and one restart from hot condition. Cranking motor shall be capable of six equally spread starts per hour, three starts in quick succession from cold condition and one restart from hot condition. The coal conveyor and crusher motors shall be suitable for 3 consecutive hot starts with maximum 20 starts per day. Pump motor subject to reverse rotation shall be designed to withstand the stresses encountered when starting with shaft rotating at 125% rated speed in reverse direction.	
5.2.4	HT pump motors shall be suitable to start with forward rotation.	
5.2.5	The motors shall be designed to withstand 120% of rated speed for 2 minutes without any mechanical damage	
5.3	<u>STRESS DURING BUS TRANSFER.</u>	
5.3.1	The motor may be subjected to sudden application of 150% rated voltage during bus transfer, due to the phase difference between the incoming voltage and motor residual voltage.	
5.3.2	The motor shall be designed to withstand any torsional and/or high current stresses, which may result, without experiencing any deterioration in the normal life and performance characteristics.	
5.4	<u>LOCKED ROTOR WITHSTAND TIME</u>	
5.4.1	The locked rotor withstand time under hot condition at 110% rated voltage shall be more than motor starting time by at least 2.5 seconds for motors up to 20 seconds starting time and by 5 seconds for motor with more than 20 seconds starting time.	

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5.4.2	Starting time mentioned above is at minimum permissible voltage of 80% rated voltage.	
5.4.3	Hot thermal withstand curve shall have a margin of at least 10% over the full load current of the motor to permit relay setting utilizing motor rated capacity	
6.0	<u>SPECIFIC REQUIREMENTS</u>	
6.1	<u>ENCLOSURE</u>	
6.1.1	All indoor motor enclosures shall conform to the degree of protection IP-55 unless otherwise specified and outdoor motor enclosure shall confirm to degree of IPW-55. Motor for outdoor or semi-outdoor service shall be of weather-proof construction.	
6.1.2	For hazardous area approved type of increased safety enclosure shall be furnished.	
6.2	<u>COOLING</u>	
6.2.1	The motor shall be self ventilated type, either totally enclosed fan cooled (TEFC) or closed air circuit air- cooled (CACA).	
6.2.2	In case water cooling is required for very large motors, prior approval of the customer is to be obtained before proceeding ahead with design & manufacture.	
6.3	<u>WINDING AND INSULATION</u>	
6.3.1	All insulated winding shall be of copper.	
6.3.2	All motors shall have class F insulation but limited to class B temperature rise.	
6.3.3	Windings shall be impregnated to make them non-hygroscopic and oil resistant.	

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6.4 TROPICAL PROTECTION

6.4.1 All motors shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion.

6.4.2 All fittings and hardware shall be corrosion resistant.

6.5 BEARINGS

6.5.1 Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application.

6.5.2 Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred.

6.5.3 Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area.

6.5.4 Sleeve bearings shall be split type, ring oiled, with permanently aligned, close running shaft sleeves.

6.5.5 Grease lubricated bearings shall be prelubricated and shall have provisions for in-service positive lubrication with drains to guard against over lubrication.

6.5.6 Oiled bearing shall have an integral self cooled oil reservoir with oil ring inspection ports, oil sight glass with oil level marked for standstill and running conditions and oil fill and drain plugs.

6.5.7 Forced lubricated or water cooled bearing shall not be used without prior approval of Owner.

6.5.8 Lubricant shall not deteriorate under all service conditions. The lubricant shall be limited to normally available types with IOC equivalent.

6.5.9 Bearings shall be insulated as required to prevent shaft current and resultant bearing damage.

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6.6	<u>NOISE & VIBRATION</u>	
6.6.1	The noise level shall be as per statutory acceptance (IS/IEC).	
6.6.2	The peak amplitude of the vibration shall be within IS/IEC specified limits.	
6.7	<u>MOTOR TERMINAL BOX</u>	
6.7.1	Motor terminal box shall be phase segregated (PSTB) type and located in accordance with Indian Standards clearing the motor base- plate/ foundation.	
6.7.2	Terminal box shall be capable of being turned 360 Deg. in steps of 180 Deg. For HT motors and 90 Deg. for LT motors unless otherwise approved.	
6.7.3	The terminal box shall be split type with removable cover with access to connections and shall have the same degree of protection as motor.	
6.7.4	The terminal box shall have sufficient space inside for termination/connection of XLPE insulated armoured aluminium cables.	
6.7.5	Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame.	
6.7.6	The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.	
6.7.7	The terminal box shall be capable of withstanding maximum system fault current for duration of 0.25 sec.	
6.7.8	For 11kV and 3.3kV motor, the terminal box shall be phase-segregated type. The neutral leads shall be brought out in a separate terminal box (not necessarily phase segregated type) with shorting links for star connection.	
6.7.9	Motor terminal box shall be furnished with suitable cable lugs and double compression brass glands to match with cable used.	
6.7.10	The gland plate for single core cable shall be non-magnetic type.	

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6.7.11 Due to any reason, if the terminal box is found to be not suitable for the approved cable size for either HT/LT motors, then the bidder shall arrange necessary adopter box to facilitate the termination of cables. The adopter box shall be of the same short circuit rating and specifications as the main terminal box. The adopter box shall be located as near as possible to the main terminal box. The interconnecting cabling between adopter box and main terminal box along with providing suitable cable glands and termination kits as applicable shall also be done by the bidder. 6.8 <u>GROUNDING</u> 6.8.1 The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GS bolts and washer 6.8.2 The grounding connection shall be suitable for accommodation of ground conductors as follows : Motor above 90 kW : 75 x 10 mm GS Flat Motor above 30 kW up to 90 kW : 50 x 6 mm GS Flat Motor above 5 kW up to 30 kW : 25 x 6 mm GS Flat Motor up to 5 kW : 8 SWG GS Wire 6.8.3 The cable terminal box shall have a separate grounding pad 6.9 <u>RATING PLATE</u> In addition to the minimum information required by IS, the following information shall be shown on motor rating plate: (a) Temperature rise in Deg.C under rated condition and method of measurement. (b) Degree of protection.		

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(c) Bearing identification no. and recommended lubricant. (d) Location of insulated bearings. 6.10 <u>CONSTRUCTION</u> 6.10.1 Stator Core The Stator Core Lamination shall be made of high-grade silicon/magnetic steel sheet varnished on both sides and pressed to form rigid core. 6.10.2 Rotor The rotor construction shall be such that in case of dislodging of the rotor bar from the end ring, it should not come out and hit the stator core/stator winding and damage. 7.0 <u>ACCESSORIES</u> 7.1 <u>GENERAL</u> Accessories shall be furnished, as listed below, or if otherwise required by driven equipment specification or application 7.2 <u>SPACE HEATER</u> 7.2.1 Motor of rating 30 kW and above shall be provided with space heaters, suitably located for easy removal or replacement. 7.2.2 The space heater shall be rated 240 V, 1 phase 50 Hz and sized to maintain the motor internal temperature above dew point when the motor is idle. 7.3 <u>TEMPERATURE DETECTORS</u> 7.3.1 All 11kV and 3.3kV motors shall be provided with twelve (12) nos. Simplex type winding temperature detectors, four (4) nos. per phase.		

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7.3.2	11kV and 3.3kV motor bearing shall be provided with duplex type temperature detectors.	
7.3.3	The temperature detector mentioned above shall be resistance type, 3 wire, platinum wound, 100 Ohms at 0°C.	
7.3.4	Leads of all simplex type motor winding RTDS and motor bearing RTDS shall be wired up to respective switchgear metering & protection compartment. From which one set of RTDS will be connected to numerical protection relay and another set shall be kept free for DCS connectivity.	
7.3.5	Five numbers of Temperature detectors / thermistors shall be provided for L.T. Motors above 90 kW (3 nos. Winding temperatures & 2 nos. bearing temperatures).	
7.4	<u>INDICATOR/SWITCH</u>	
7.4.1	Dial type local indicator with alarm contacts shall be provided for the following :	
	(a) 11kV and 3.3kV motor bearing temperature	
	(b) Hot and cold air temperature of the closed air circuit for CACA and CACW motor	
7.4.2	Flow switches shall be provided for monitoring cooling water flow of CACW motor and oil flow of forced lubrication bearing, if used.	
7.4.3	Alarm switch contact rating shall be minimum 0.5 A at 220V D.C. and 5A at 240V A.C.	
7.5	<u>CURRENT TRANSFORMER FOR DIFFERENTIAL PROTECTION</u>	
7.5.1	Motor 1000 KW and above shall be provided with three differential current transformers mounted over the neutral leads within the enclosure. Loose 3 nos. CT for mounting on switchgear side shall be in bidder's scope.	

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7.5.2	The arrangement shall be such as to permit easy access for C.T. testing and replacement. Current transformer characteristics shall match Owner's requirements to be intimated later.	
7.6	<u>ACCESSORY TERMINAL BOX</u>	
7.6.1	All accessory equipment such as space heater, temperature detector, current transformers etc., shall be wired to and terminated in terminal boxes, separate from and independent of motor (power) terminal box.	
7.6.2	Accessory terminal box shall be complete with double compression brass glands and pressure type terminals to suit cable connections.	
7.7	<u>DRAIN PLUG</u>	
	Motor shall have drain plugs so located that they will drain the water, resulting from the condensation or other causes from all pockets of the motor casing.	
7.8	<u>LIFTING PROVISIONS</u>	
	Motor weighing 25 Kg. or more shall be provided with eyebolt or other adequate provision of lifting.	
7.9	<u>DOWEL PINS</u>	
	The motor shall be designed to permit easy access for drilling holes through motor feet or mounting flange for installation of dowel pins after assembling the motor and driven equipment.	
7.10	<u>PAINTING</u>	
	Motor including fan shall be painted with corrosion proof paints of colour shade (RAL-7032).	
8.0	<u>TESTS</u>	
8.1	<u>ROUTINE AND TYPE TEST:</u>	

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Tests are to be conducted for HT and LT motors 60kW and above in presence of Mahagenco representative and contractor as per IS: 325 and required copies of test certificates are to be furnished for approval and despatch clearance. In addition, following tests shall have to be carried out on the motors in presence of MAHAGENCO representative & contractor on LT & HT motors. For Motors below 60kW type and routine test conducted as per IS325 shall be witnessed by contractor and test certificate shall be submitted for review of Mahagenco & Dispatch clearance								
8.1.1 <u>FOR HT MOTORS:</u> (a) Impulse test by 1.2 / 50 micro sec. On sample coil of Stator winding insulation as type test as per IEC-671/IS 14422,1995 test voltages as under <table><tr><td>Voltage rating of motor</td><td>Impulse Test Voltage</td></tr><tr><td>3.3 kV</td><td>: 18 kV peak</td></tr><tr><td>11 kV</td><td>: 49 kV peak</td></tr></table> (b) Tan delta, charging current and dielectric loss measurements on each phase of motor stator winding as routine test (c) Polarization Index Test as per IS:7816 as routine test (d) Tan delta measurement on coils (e) Surge withstand test for inter turn insulation. (f) Test to diagnose rotor bar failure during manufacture. Tests indicated at (d), (e), (f) shall be carried out during manufacture of the coils and shall be furnished for verification .			Voltage rating of motor	Impulse Test Voltage	3.3 kV	: 18 kV peak	11 kV	: 49 kV peak
Voltage rating of motor	Impulse Test Voltage							
3.3 kV	: 18 kV peak							
11 kV	: 49 kV peak							
8.1.2 <u>FOR HT & LT MOTORS:</u> (a) Test for suitability of IP55/ IPW– 55 as per IS 4691 as type test. Type test certificate for first numeral shall be acceptable in lieu to test,								

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provided the test motor is identical to motor being supplied. Second numeral test shall be carried out on one motor of each type and rating. (b) Fault Withstand Test for main terminal box as type test. Type test certificate shall be acceptable, if the test is conducted on exactly identical terminal box within last three years. (c) Test for noise level as routine test. (d) Test for vibration as routine test. (e) Overspeed test as type test. 8.2 <u>TEST WITNESS:</u> Test shall be performed in presence of Owner/Purchaser's representative so desired by the Owner/Purchaser. The Contractor shall give at least fifteen (15) days advance notice of the date when the tests are to be carried out.		

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<u>AC & DC MOTOR</u> <u>DATASHEET – A</u>				
SR. NO.	ITEM	UNIT		
1.0	<u>AUXILIARY POWER SUPPLY</u>			
1.1	<u>H.T. SUPPLY</u>			
	11kV, 3Ø, 3W, 50 Hz non-effectively earthed		Motors rated 1000 kW and above	
	Fault level 44 kA symm			
	3.3kV, 3Ø, 3W, 50 Hz, non-effectively earthed		Motors above 160 kW and below 1000kW	
	Fault level 40 kA symm			
1.2	<u>L.T. SUPPLY</u>			
	415V, 3Ø, 3W, 50 Hz effectively earthed		Motors below and including 160kW	
	Fault level 50 kA symm			
	240V, 1Ø, 2W, 50 Hz effectively earthed		Lighting, space heating, A.C. control & protective devices	
1.3	<u>D.C. SUPPLY</u>			
	220V, 2W, unearthed		D.C. alarm, control & protective devices	
	Fault level 25* kA.			
	Indicative only, the actual value will be decided by the Bidder, after substantiating the same by calculation			
2.0	<u>RANGE OF VARIATION</u>			

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SR. NO.	ITEM	UNIT	
2.1	<u>A.C. SUPPLY:</u>		
	Voltage		± 10%
	Frequency		± 5%
	Combined Voltage & frequency		± 10% (absolute sum)
	During starting of large motor, the voltage may drop to 80% of the rated voltage for a period of 60 seconds. All electrical equipment while running shall successfully ride over such period without affecting system performance		
2.2	<u>D.C. SUPPLY</u>		
	Voltage		198 to 240 Volt

CONSULTANT : PROCON ENGINEERS



TITLE

LV MOTORS DATA SHEET-A

1X660 MW BHUSAWAL TPP

SPECIFICATION NO.

VOLUME II B

SECTION

D

REV NO. 00

DATE 28.01.2019

SHEET 1

OF 1

- | | | | |
|------|---|---|---|
| 1.0 | Design ambient temperature | : | 50 °C |
| 2.0 | Maximum acceptable kW rating of LV motor | : | 160KW |
| 3.0 | Installation (Indoors/ Outdoors) | : | As required |
| 4.0 | Details of supply system | | |
| a) | Rated voltage (with variation) | : | 415V $\pm$ 10% |
| b) | Rated frequency (with variation) | : | 50 Hz (+5% and -5%) |
| c) | Combined voltage & freq. variation | : | 10% (sum of absolute values) |
| d) | System fault level at rated voltage | : | 50 kA for 1 sec |
| e) | Short time rating for terminal boxes | : | |
| | o 90 kW and upto 160kW (Breaker controlled) | : | 50 KA for 1 sec. |
| | o Below 90 kW (SFU + Contactor controlled) | : | 50 KA protected by fuse for 0.2 sec |
| f) | LV System grounding | : | Effectively grounded |
| 5.0 | Class of insulation | : | Class 'F', with temp rise limited to class B. |
| 6.0 | Minimum voltage for starting (As percentage of rated voltage) | : | 80% of rated voltage |
| 7.0 | Power cables data | : | Shall be given during Detailed engg |
| 8.0 | Earth Conductor Size & Material | : | Shall be given during Detailed engg |
| 9.0 | Space heater supply | : | 240 V, 1 ϕ , 50 Hz |
| 10.0 | Rating up to which Single phase motor | : | Acceptable below 0.20 kW |
| 11.0 | Additional tests | : | As per QP and customer motor spec |
| 12.0 | Flame-proof motor | | |
| a) | Enclosure suitable (As per IS:2148) | : | As per requirement |
| b) | Classification of Hazardous area (As per IS: 5572 part-I) | : | As per requirement |
| 13.0 | Makes | : | As per ANNEXURE-I |
| 14.0 | Paint shade | : | RAL 7032 |
| 15.0 | Degree of Protection of enclosure (motors): | : | INDOOR IP-55
OUTDOOR IPW-55 |
| 16.0 | Energy efficiency | : | IE3 as per IS:12615: 2011 |

❖ Also detail Customer spec. for Motors to be referred as enclosed with spec.

ANNEXURE-I

SUB-VENDOR LIST

The list of approved make of the LT Motors are as mentioned below:

S.No.	LIST OF LT MOTORS
1.	BHARAT BIJLEE LTD.
2.	CROMPTON GREAVES
3.	ASEA BROWN BOVERI
4.	KIRLOSKAR ELECTRIC CO LTD.
5.	NGEF
6.	SIEMENS
7.	MARATHON
8.	GE-POWER
9.	RAJINDRA ELECT INDUSTRIES
10.	LAXMI HYDRAULICS PVT. LTD

However, the final list of makes for the LT Motors is subjected to BHEL/Customer approval, during contract stage, without any commercial implications.

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

1. For the purpose of clarity, it may please be noted that the information given in regard to the cables to be routed through WinPath as per the system elaborated below is called "Cable List", while the term "Cable Schedule" applies to the cable list with routing information added after routing has been carried out.
2. The cable list shall be entered as an MS Excel file in the format as per enclosed template EXT_CAB_SCH_FORMAT.XLS. No blank lines, special characters, header, footer, lines, etc. shall be introduced in the file. No changes shall be made in the title line (first line) of the template.
3. The field properties shall be as under:
 - a. UNITCABLENO: A/N, up to sixteen (16) characters; each cable shall have its own unique, unduplicated cable number. In case this rule is violated, the cable cannot be taken up for routing.
 - b. FROM: A/N, up to sixty (60) characters; the "From" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - c. TO: A/N, up to sixty (60) characters; the "To" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - d. PURPOSE: A/N, up to sixty (60) characters; the purpose (i.e. power cable/ indication/ measurement, etc.) to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - e. REMARKS: A/N, up to forty (40) characters; Any information pertinent to routing to be specified here (e.g., cable number of the cable redundant to the cable number being entered). Information in excess of 40 characters will be truncated after 40 characters.
 - f. CABLESIZE: A/N, 7 characters exactly as per the codes indicated below shall be specified here. The program cannot route cables described in any other way/ format.
 - g. PATHCABLENO: Field reserved for utilization by the program. User shall not enter any information here.
4. One list shall be prepared for each system/ equipment (i.e., separate and unique cable lists shall be prepared for each system).
5. The cables shall be described as per the scheme listed below:

A	NN	A	NNN
Cable	No. of cores	Cable code	Cable size
Voltage	(e.g. 01,03,3H, 07)	(See C below)	(e.g. 035,185,2.5, 0.5)
Code (see B below)			

(A) SYSTEM VOLTAGE CODES:

(ac) A = 11KV, B = 6.6KV, C = 3.3KV, D = 415V, E = 240V, F = 110V
(dc) G = 220V, H = 110V, J = 48V, K = +24V, L = -24V

(B) CABLE VOLTAGE CODES:

A = 11KV (Power cables)

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

B = 6.6KV (Power cables)
C = 3.3KV (Power cables)
D = 1.1KV (LV & DC system power & control cables)
E = 0.6KV (0.5 sq. mm. Control cables)

(C) CABLE CODES

PVC Copper

A = Armoured FRLS	B = Armoured Non-FRLS
C = unarmoured FRLS	D = Unarmoured Non-FRLS

PVC Aluminium

E = Armoured FRLS	F = Armoured Non-FRLS
G = unarmoured FRLS	H = Unarmoured Non-FRLS

XLPE Copper

J = Armoured FRLS	K = Armoured Non-FRLS
L = unarmoured FRLS	M = Unarmoured Non-FRLS

XLPE Aluminium

N = Armoured FRLS	P = Armoured Non-FRLS
Q = unarmoured FRLS	R = Unarmoured Non-FRLS

S = FIRE SURVIVAL CABLES
T = TOUGH RUBBER SHEATH
U = OVERALL SCREENED
V = PAIRED OVERALL SCREENED
W = PAIRED INDIVIDUAL SCREENED
Y = COMPENSATING CABLES
I = PRE-FABRICATED CABLES
Z = JELLY FILLED CABLES



TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-415-100-N011**

SECTION: **I**

SUB-SECTION: **ID**

REV. NO. **00** DATE 10.12.2019

SHEET **1** OF **1**

SUB-SECTION – IC

SPECIFIC TECHNICAL REQUIREMENTS (C&I)

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 236 of 718
SR. NO.	ITEM	DESCRIPTION	
		thermowells.	
1.9.8	Accessories	(a) Adjustable nipple-union-nipple (½", Sch 80 x ½" NPT M) with thermowell connection.	
		(b) Compression fittings/unions.	
		(c) Flanges etc. (for flanged connections only).	
		(d) Forged barstock thermowell as per ASME PTC code. Process connection M 33 x 2 (M) in general or 1½" Flanged for Flue gas / Furnace / Air etc. application. Material of construction of Thermowell: SS 316 : In general Inconel: For flue gas application Tungsten carbide : For coal mill application.	
1.9.9	Name plate	Tag number, service engraved in stainless steel tag plate.	
1.10	<u>RESISTANCE TEMPERATURE DETECTOR</u>		
1.10.1	Type	Platinum (Duplex), Ungrounded.	
1.10.2	Resistance	100 ohm at 0 °C.	
1.10.3	Base	Wound on ceramic (anti-inductive).	
1.10.4	Wiring	3 / 4 Wire.	

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 237 of 718
SR. NO.	ITEM	DESCRIPTION	
1.10.5	Protecting Tube		
(a)	O.D.	8 mm.	
(b)	Material	SS-316, Seamless.	
(c)	Filling	Magnesium oxide (Purity above 99.4%).	
1.10.6	Response time	(a) < 20 seconds for measurement.	
		(b) < 10 seconds for control.	
1.10.7	Calibration	DIN 43760.	
1.10.8	Accuracy	± 0.5%.	
1.10.9	Head:		
(a)	Type	IP-65 universal screwed type.	
(b)	Material	Die cast aluminium or better.	
(c)	Terminal blocks	Nickel plated Brass-screw type / silver plated.	
(d)	Cable connection	½" NPT gland and grommet.	
(e)	Others	Terminal head cover with SS chain and suitable gasket. All thermowells in the high velocity steam service shall be checked for Strouhal's frequency limit to arrive at a safe size and design of thermowells.	
1.10.10	Accessories	(a) Adjustable nipple-union-nipple (½" Sch 80 x ½" NPT M) with Thermowell connection.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 238 of 718
SR. NO.	ITEM	DESCRIPTION	
		(b) Compression fittings / unions.	
		(c) Flanges etc. (for flanged connections only)	
		(d) Forged / barstock Thermowell as per ASME PTC code. Process connection M33 x 2 (M). Material of construction of Thermowell: SS 316: In general. Inconel: For flue gas application. Tungsten carbide: For coal mill application.	
1.10.11	Name plate	Tag number, service engraved in stainless steel tag plate	
1.11	<u>PRESSURE SWITCH</u>		
1.11.1	Type	(a) Piston for high pressure application.	
		(b) Bellow / Diaphragm for low pressure application.	
1.11.2	Sensing element material	AISI SS-316. All other wetted part SS316.	
1.11.3	Case Material	Die-cast aluminium alloy, neoprene gasket.	
1.11.4	Setter Scale	Black graduation on white linear scale. Graduation 0-100% with red pointer for set points.	

CONSULTANT : PROCON ENGINEERS



TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-415-100-N011**

SECTION: **I**

SUB-SECTION: **ID**

REV. NO. **00** DATE 10.12.2019

SHEET **2** OF **1**

SUB-SECTION – ID

DATASHEET-A

DATA SHEET - A												SPECIFICATION NO.:	PE-TS-415-100-N011
MISCELLANEOUS PUMPS (Vertical Pumps)												REV. NO.: 00	DATE : 1/1/2020
1 X 660 MW BHUSAWAL TPP UNIT-6												SECTION:	I D
Sl. No.	DESCRIPTION	POTABLE WATER PUMPS (PLANT)	POTABLE WATER PUMPS (COLONY)	APH/ESP WASH PUMPS	SERVICE WATER PUMPS	SCR PUMPS	CT MAKEUP PUMPS	AHP PUMPS	FGD PUMPS	INTAKE WATER BOOSTER PUMPS	ASH WATER PUMPS	RAW WATER PUMPS	ACW PUMPS
1.0	SERVICE												
1.1	Total no. of pumps for Project	2	2	2	2	2	3	2	2	3	2	3	2
1.2	No. of working & standby pumps	(1W+1S) for station	(1W+1S) for station	(1W+1S) for station	(1W+1S) for station	(1W+1S) for station	(2W+1S) for station	(1W+1S) for station	(1W+1S) for station	(2W+1S) for station	(1W+1S) for station	(2W+1S) for station	(1W+1S) for station
1.3	Liquid Handled (ref. water analysis enclosed herein)	Clarified Water	Clarified Water	Clarified Water	Clarified Water	Clarified Water	Clarified Water	Clarified Water	Clarified Water	Raw Water	Raw Water	Raw Water	Clarified Water
1.4	Location	Clarified Water P/H (Non DM)	Clarified Water P/H (Non DM)	Clarified Water P/H (Non DM)	Clarified Water P/H (Non DM)	Clarified Water P/H (Non DM)	Clarified Water P/H (Non DM)	Clarified Water P/H (Non DM)	Clarified Water P/H (Non DM)	Intake Water P/H	Raw water P/H	Raw water P/H	CW/ACW P/H
1.4.1	Indoor / Outdoor	Indoor	Indoor	Indoor	Indoor	Indoor	Indoor	Indoor	Indoor	Indoor	Indoor	Indoor	Indoor
1.5	Duty	Intermittent	Intermittent	Intermittent	Intermittent	Intermittent	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous
1.6	Specific gravity	1	1	1	1	1	1	1	1	1	1	1	1
1.7	No. of pumps working in parallel	-	-	-	-	-	2	-	-	-	-	-	-
1.8	System design pressure (kg/sqcm), g	10	10	13	10	10	10	10	10	10	10	10	7.5
2.0	DESIGN PARAMETERS												
2.1	Design capacity each, M ³ /hr	20	25	420	150	60	850	120	200	1500	900	1160	3910
2.2	Total dynamic head (MWC) (At Bowl, excluding Pumps Internal frictional losses upto discharge)	57	53	86	65	68	12	62	55	28	35	20	46
2.3	• Suction Pressure(MWC) • Floor Level- for Pump Mounting • Min. W.L. • Max. W.L. • Sump Invert Level • Crane Hook Level • Crane Capacity Available (Maximum Weight of Single Assembly at Pump Erection shall not exceed 80% of Crane Capacity)	Submerged Suction RL (+) 214.34 M RL (+) 210 M RL (+) 213.34 M RL (+) 208 M RL (+) 220.14 M 10 Ton	Submerged Suction RL (+) 214.34 M RL (+) 210 M RL (+) 213.34 M RL (+) 208 M RL (+) 220.14 M 10 Ton	Submerged Suction RL (+) 214.34 M RL (+) 210 M RL (+) 213.34 M RL (+) 208 M RL (+) 220.14 M 10 Ton	Submerged Suction RL (+) 214.34 M RL (+) 210 M RL (+) 213.34 M RL (+) 208 M RL (+) 220.14 M 10 Ton	Submerged Suction RL (+) 214.34 M RL (+) 210 M RL (+) 213.34 M RL (+) 208 M RL (+) 220.14 M 10 Ton	Submerged Suction RL (+) 214.34 M RL (+) 210 M RL (+) 213.34 M RL (+) 208 M RL (+) 220.14 M 10 Ton	Submerged Suction RL (+) 214.34 M RL (+) 210 M RL (+) 213.34 M RL (+) 208 M RL (+) 220.14 M 10 Ton	Submerged Suction RL (+) 214.34 M RL (+) 210 M RL (+) 213.34 M RL (+) 208 M RL (+) 220.14 M 10 Ton	Submerged Suction RL (+) 209.5 M RL (+) 210 M RL (+) 206.3 M RL (+) 207.3 M RL (+) 214.5 M 5 Ton	Submerged Suction RL (+) 219.4 M RL (+) 213.38 M RL (+) 218.1 M RL (+) 210.88 M RL (+) 224.4 M 10 Ton	Submerged Suction RL (+) 219.4 M RL (+) 213.38 M RL (+) 218.1 M RL (+) 210.88 M RL (+) 224.4 M 10 Ton	Submerged Suction RL (+) 219.4 M RL (+) 213.38 M RL (+) 218.1 M RL (+) 210.88 M RL (+) 224.4 M 60 Ton
2.4	Design Temperature (°C)	60	60	60	60	60	60	60	60	60	60	60	60
2.5	Maximum permissible speed of pump (RPM)	Preferably 1500 RPM, however 3000 RPM is also acceptable with a proven model of 3000 RPM Pump Supply.	Preferably 1500 RPM, however 3000 RPM is also acceptable with a proven model of 3000 RPM Pump Supply.	1500	1500	Preferably 1500 RPM, however 3000 RPM is also acceptable with a proven model of 3000 RPM Pump Supply.	1500	1500	1500	1500	1500	1500	1500
2.6	Max. limit on shut off head Corresponding to pump TDH (MWC) at 51.5 Hz	Not to exceed 90 MWC	Not to exceed 90 MWC	Not to exceed 125 MWC	Not to exceed 95 MWC	Not to exceed 95 MWC	Not to exceed 90 MWC	Not to exceed 95 MWC	Not to exceed 95 MWC	Not to exceed 90 MWC	Not to exceed 90 MWC	Not to exceed 90 MWC	Not to exceed 70 MWC
2.7	Pump Discharge - above floor / below floor	Above Floor											
2.8	Discharge pipe (ODXTHK),(mmxmm)	89.5 X 4.8	89.5 X 4.8	273 X 6	166.5 X 5.4	115 X 5.4	355.6 X 6	166.5 X 5.4	219.1 X 6	508 X 6	355.6 X 6	406.4 x 6	813 x 8
2.9	Operating range	-----30-130% of design duty point flow-----											
2.10	Motor rating	MAXIMUM OF FOLLOWING A) Continuous motor rating (at 50 deg. C ambient) shall be 5% above the max power requirement at any condition of the entire characteristic curve of the pump (viz. 0-130%). B) 10 % margin over power requirement at rated duty point. C) Pump shaft input power required considering the overloading of the pump assuming single pump operation in the event of tripping of one or more of the pumps operating in parallel.											
2.11	Permissible tolerance in rated capacity & TDH	no negative tolerance											
2.12	Permissible tolerance in efficiency at rated capacity(%)	no negative tolerance											
2.13	Performance/Design Standard	IS-1710 / HIS											
3.0	CONSTRUCTION FEATURES												
3.1	Pump type	Vertical wet pit type	Vertical wet pit type	Vertical wet pit type	Vertical wet pit type	Vertical wet pit type	Vertical wet pit type	Vertical wet pit type	Vertical wet pit type	Vertical wet pit type	Vertical wet pit type	Vertical wet pit type	Vertical Turbine Type
3.2	Impeller type	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
3.3	Casing type	Vertical Turbine Type											
3.4	Coupling type	Flexible	Flexible	Flexible	Flexible	Flexible	Flexible	Flexible	Flexible	Flexible	Flexible	Flexible	Flexible
3.5	Sealing arrangement	Self Water/Gland packing	Self Water/Gland packing	Self Water/Gland packing	Self Water/Gland packing	Self Water/Gland packing	Self Water/Gland packing	Self Water/Gland packing	Self Water/Gland packing	Self Water/Gland packing	Self Water/Gland packing	Self Water/Gland packing	Self Water/Gland packing
3.6	Type of Lubrication	Self Water-Liquid	Self Water-Liquid	Self Water-Liquid	Self Water-Liquid	Self Water-Liquid	Self Water-Liquid	Self Water-Liquid	Self Water-Liquid	Self Water-Liquid	Self Water-Liquid	Self Water-Liquid	Self Water-Liquid
3.7	Pump characteristics	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable
3.8	Drain Plugs, vent with valve, lifting lugs, etc.	To be Provided											
4.0	MATERIALS OF CONSTRUCTION												
4.1	Casing & Suction Bell	2 % Ni Cl	2 % Ni Cl	2 % Ni Cl	2 % Ni Cl	2 % Ni Cl	2 % Ni Cl	2 % Ni Cl	2 % Ni Cl	2 % Ni Cl	2 % Ni Cl	2 % Ni Cl	2 % Ni Cl
4.2	Column Pipe & Discharge Head	IS 2062 (MS) 10 mm	IS 2062 (MS) 10 mm	IS 2062 (MS) 10 mm	IS 2062 (MS) 10 mm	IS 2062 (MS) 10 mm	IS 2062 (MS) 10 mm	IS 2062 (MS) 10 mm	IS 2062 (MS) 10 mm	IS 2062 (MS) 10 mm	IS 2062 (MS) 10 mm	IS 2062 (MS) 10 mm	IS 2062 (MS) 10 mm
4.3	Minimum column pipe thickness, mm												
4.4	Impeller	ASTM-A-351 Gr. CF8M	ASTM-A-351 Gr. CF8M	ASTM-A-351 Gr. CF8M	ASTM-A-351 Gr. CF8M	ASTM-A-351 Gr. CF8M	ASTM-A-351 Gr. CF8M	ASTM-A-351 Gr. CF8M	ASTM-A-351 Gr. CF8M	ASTM-A-351 Gr. CF8M	ASTM-A-351 Gr. CF8M	ASTM-A-351 Gr. CF8M	ASTM-A-351 Gr. CF8M
4.5	Shaft/ Line Shaft	SS 410	SS 410	SS 410	SS 410	SS 410	SS 410	SS 410	SS 410	SS 410	SS 410	SS 410	SS 410
4.6	Shaft Sleeves	SS 410 (hardened)	SS 410 (hardened)	SS 410 (hardened)	SS 410 (hardened)	SS 410 (hardened)	SS 410 (hardened)	SS 410 (hardened)	SS 410 (hardened)	SS 410 (hardened)	SS 410 (hardened)	SS 410 (hardened)	SS 410 (hardened)
4.7	Shaft Coupling	AISI-410 (HARDENED)	AISI-410 (HARDENED)	AISI-410 (HARDENED)	AISI-410 (HARDENED)	AISI-410 (HARDENED)	AISI-410 (HARDENED)	AISI-410 (HARDENED)	AISI-410 (HARDENED)	AISI-410 (HARDENED)	AISI-410 (HARDENED)	AISI-410 (HARDENED)	AISI-410 (HARDENED)
4.8	Wearing rings	As per manufacturer's standard	As per manufacturer's standard	As per manufacturer's standard	As per manufacturer's standard	As per manufacturer's standard	As per manufacturer's standard	As per manufacturer's standard	As per manufacturer's standard	As per manufacturer's standard	As per manufacturer's standard	As per manufacturer's standard	As per manufacturer's standard
4.9	Wetted fasteners	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316
4.10	Fasteners (others)	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316
4.11	Gland plate & Stuffing Box	Cl	Cl	Cl	Cl	Cl	Cl	Cl	Cl	Cl	Cl	Cl	Cl
4.12	Lantern Ring	Manufacturer standard	Manufacturer standard	Manufacturer standard	Manufacturer standard	Manufacturer standard	Manufacturer standard	Manufacturer standard	Manufacturer standard	Manufacturer standard	Manufacturer standard	Manufacturer standard	Manufacturer standard
4.13	Intermediate stage bearings	Thordon Type / Cutless Nitrile rubber	Thordon Type / Cutless Nitrile rubber	Thordon Type / Cutless Nitrile rubber	Thordon Type / Cutless Nitrile rubber	Thordon Type / Cutless Nitrile rubber	Thordon Type / Cutless Nitrile rubber	Thordon Type / Cutless Nitrile rubber	Thordon Type / Cutless Nitrile rubber	Thordon Type / Cutless Nitrile rubber	Thordon Type / Cutless Nitrile rubber	Thordon Type / Cutless Nitrile rubber	Thordon Type / Cutless Nitrile rubber
4.14	Mech. seal	As per manufacturer's standard	As per manufacturer's standard	As per manufacturer's standard	As per manufacturer's standard	As per manufacturer's standard	As per manufacturer's standard	As per manufacturer's standard	As per manufacturer's standard	As per manufacturer's standard	As per manufacturer's standard	As per manufacturer's standard	As per manufacturer's standard
4.15	Gland Packing	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)
4.16	Base/ Sole Plate	Carbon steel (IS:2062) with Epoxy Coating	Carbon steel (IS:2062) with Epoxy Coating	Carbon steel (IS:2062) with Epoxy Coating	Carbon steel (IS:2062) with Epoxy Coating	Carbon steel (IS:2062) with Epoxy Coating	Carbon steel (IS:2062) with Epoxy Coating	Carbon steel (IS:2062) with Epoxy Coating	Carbon steel (IS:2062) with Epoxy Coating	Carbon steel (IS:2062) with Epoxy Coating	Carbon steel (IS:2062) with Epoxy Coating	Carbon steel (IS:2062) with Epoxy Coating	Carbon steel (IS:2062) with Epoxy Coating
4.17	Thrust pad (if applicable)	Carbon Steel	Carbon Steel	Carbon Steel	Carbon Steel	Carbon Steel	Carbon Steel	Carbon Steel	Carbon Steel	Carbon Steel	Carbon Steel	Carbon Steel	Carbon Steel
4.18	Connecting Pipe material (for deciding counterflange material)	Piping upto and including 150NB shall be Carbon Steel ERW, IS:1239 (Heavy Grade) and piping above 150 NB shall be Carbon Steel (IS:2062), rolled and welded conforming to IS:3589.											
5.0	MANDATORY SPARES FOR PUMP-MOTOR SET												
5.1	Spares for Pumps												
5.1.1	Complete Bowl Assembly	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	-
5.1.2	Set of Impellers	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 set (as required for one pump)
5.1.3	Set of line & pump shafts	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 set (as required for one pump)
5.1.4	Casing wear rings	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 set (as required for one pump)
5.1.5	Impeller wear rings	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 set (as required for one pump)
5.1.6	Shaft sleeves	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 set (as required for one pump)
5.1.7	Shaft coupling	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	-
5.1.8	Shaft nuts and keys	1 Lot (Two (2) Sets for each type)	1 Lot (Two (2) Sets for each type)	1 Lot (Two (2) Sets for each type)	1 Lot (Two (2) Sets for each type)	1 Lot (Two (2) Sets for each type)	1 Lot (Two (2) Sets for each type)	1 Lot (Two (2) Sets for each type)	1 Lot (Two (2) Sets for each type)	1 Lot (Two (2) Sets for each type)	1 Lot (Two (2) Sets for each type)	1 Lot (Two (2) Sets for each type)	-
5.1.9	Pins (for non-reversible ratchet) (as applicable)	1 Lot (Two (2) Sets for each type)	1 Lot (Two (2) Sets for each type)	1 Lot (Two (2) Sets for each type)	1 Lot (Two (2) Sets for each type)	1 Lot (Two (2) Sets for each type)	1 Lot (Two (2) Sets for each type)	1 Lot (Two (2) Sets for each type)	1 Lot (Two (2) Sets for each type)	1 Lot (Two (2) Sets for each type)	1 Lot (Two (2) Sets for each type)	1 Lot (Two (2) Sets for each type)	-
5.1.10	Lantern rings	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	-
5.1.11	Bell mouth liner	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	-
5.1.12	Bearings Various types as applicable	1 Lot (Complete One (1) Set (one set means total requirements for one Pump) for each type)	1 Lot (Complete One (1) Set (one set means total requirements for one Pump) for each type)	1 Lot (Complete One (1) Set (one set means total requirements for one Pump) for each type)	1 Lot (Complete One (1) Set (one set means total requirements for one Pump) for each type)	1 Lot (Complete One (1) Set (one set means total requirements for one Pump) for each type)	1 Lot (Complete One (1) Set (one set means total requirements for one Pump) for each type)	1 Lot (Complete One (1) Set (one set means total requirements for one Pump) for each type)	1 Lot (Complete One (1) Set (one set means total requirements for one Pump) for each type)	1 Lot (Complete One (1) Set (one set means total requirements for one Pump) for each type)	1 Lot (Complete One (1) Set (one set means total requirements for one Pump) for each type)	1 Lot (Complete One (1) Set (one set means total requirements for one Pump) for each type)	1 set (as required for one pump)
5.1.13	Coupling set (between pump and motor) with accessories	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	1 Lot (One (1) Set for each type)	-
5.1.14	Gaskets, dust seals and 'O' ring etc.												2 sets (as required for one pump)
5.1.15	Nut and bolts etc												1 set (as required for one pump)

DATA SHEET - A												SPECIFICATION NO.:	PE-TS-415-100-N011
MISCELLANEOUS PUMPS (Vertical Pumps)												REV. NO.: 00	DATE : 1/1/2020
1 X 660 MW BHUSAWAL TPP UNIT-6												SECTION:	I D
Sl. No.	DESCRIPTION	POTABLE WATER PUMPS (PLANT)	POTABLE WATER PUMPS (COLONY)	APH/ESP WASH PUMPS	SERVICE WATER PUMPS	SCR PUMPS	CT MAKEUP PUMPS	AHP PUMPS	FGD PUMPS	INTAKE WATER BOOSTER PUMPS	ASH WATER PUMPS	RAW WATER PUMPS	ACW PUMPS
5.2	Spare for Motors												
5.2.1	Terminal plates for motors for each rating	1 LOT (1 nos. For each type & rating of Motor)	1 LOT (1 nos. For each type & rating of Motor)	1 LOT (1 nos. For each type & rating of Motor)	1 LOT (1 nos. For each type & rating of Motor)	1 LOT (1 nos. For each type & rating of Motor)	1 LOT (1 nos. For each type & rating of Motor)	1 LOT (1 nos. For each type & rating of Motor)	1 LOT (1 nos. For each type & rating of Motor)	1 LOT (1 nos. For each type & rating of Motor)	1 LOT (1 nos. For each type & rating of Motor)	1 LOT (1 nos. For each type & rating of Motor)	-
5.2.2	Heaters	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	-
5.2.3	Greasing arrangements	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	-
5.2.4	Motor of each type and rating	1 LOT (10% of the installed quantity or minimum 1 number whichever is higher)	1 LOT (10% of the installed quantity or minimum 1 number whichever is higher)	1 LOT (10% of the installed quantity or minimum 1 number whichever is higher)	1 LOT (10% of the installed quantity or minimum 1 number whichever is higher)	1 LOT (10% of the installed quantity or minimum 1 number whichever is higher)	1 LOT (10% of the installed quantity or minimum 1 number whichever is higher)	1 LOT (10% of the installed quantity or minimum 1 number whichever is higher)	1 LOT (10% of the installed quantity or minimum 1 number whichever is higher)	1 LOT (10% of the installed quantity or minimum 1 number whichever is higher)	1 LOT (10% of the installed quantity or minimum 1 number whichever is higher)	1 LOT (10% of the installed quantity or minimum 1 number whichever is higher)	-
5.2.5	Bearings (DE and NDE)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	-
5.2.6	End shield cover (driving and non driving end)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	-
5.2.7	Cooling fan	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	-
5.2.8	Motor terminal block	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	-
5.2.9	Complete set of coupling	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	1 LOT (1 set For each type & rating of Motor)	-
5.3	C&I Spares												
5.3.1	RTDs of each type & length												10% or 2 nos. whichever is more
5.3.2	Thermowell for T/C & RTDs												10% or 1 no. of each type, rating, length used in the system whichever is more
Mandatory Spare Note: 1. Whenever the quantity is indicated as a percentage, it shall mean percentage of total population of that item in the station (project) unless specified otherwise, and the fraction will be rounded off to the next higher whole number. Wherever the requirement has been specified a 'set', it will include the total requirement of the item for a unit, module or the station or as specified. Where it is not specified, a 'set' would mean the requirement for the single equipment/system as the case may be. Also, the 'set' would include all components required to replace the item. 2. In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantiles generally in line with the approach followed as above.													
6.0	Bid Evaluation	NA	NA	NA	NA	NA	Rs 4.5 LACS / KW	Rs 4.5 LACS / KW	Rs 4.5 LACS / KW	Rs 4.5 LACS / KW	Rs 4.5 LACS / KW	Rs 4.5 LACS / KW	Rs 4.5 LACS / KW
6.1	Bid evaluation rate												
6.2	Maximum permissible efficiency for Bid evaluation												
6.2.1	Pump Efficiency						86	70	74	85	81	86	86
6.2.2	Motor Efficiency						93.6	93.3	94.0	95.3	95	94.7	95.0
Notes :													
1	Material of construction for other components not specified above shall be similarly selected in line with the above for the duty intended and subject to approval.												
2	For items stated as not applicable by bidder, shall have to be supplied without any cost implication to BHEL in the event they are found to be applicable during detail engineering stage.												
3	For all HT motor driven pumps (wherever applicable), bidder shall provide flat surface with dimensions 60 MM x60 MM on bearing Housing for mounting vibration measuring block and a key slots of dimensions 30MM (L) X 15 MM (W) X 3 MM (D) on each pump shaft or some other suitable location which shall be confirmed during detail engineering by BHEL for Phase Marker.												
4	Wherever SS material is coming in contact with non SS material, suitable isolation (rubber etc.) shall be provided to avoid galvanic corrosion.												

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: III-E1
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section-2
REV: R0	WATER TREATMENT SYSTEMS		Page 41 of 313
<u>ANNEXURE-I</u> <u>ANALYSIS OF RAW WATER</u>			
<u>SR. NO.</u>	<u>PARAMETERS</u>	<u>UNITS</u>	<u>VALUES</u>
1.0	pH		8.0 – 8.5
2.0	Temperature	°C	22 - 30
3.0	Conductivity	µS/cm	1300
4.0	Colour	Hazen Units	Not Available
5.0	Odour		Not Available
6.0	Taste		Not Available
7.0	TDS	ppm	870
8.0	P-Alkalinity as CaCO ₃	ppm	Nil
9.0	M-Alkalinity as CaCO ₃	ppm	400
10.0	T – Alkalinity as CaCO ₃	ppm	400
11.0	Organic Matter as KMnO ₄	ppm	50
12.0	Iron (as Fe)	ppm	1
13.0	Turbidity (NTU)	ppm	100 during Non – Monsoon Up to 10,000 during Monsoon
14.0	CATIONS		
	(a) Ca as CaCO ₃	ppm	295
	(b) Mg as CaCO ₃	ppm	77
	(c) Na as CaCO ₃	ppm	203

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: III-E1
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section-2
REV: R0	WATER TREATMENT SYSTEMS		Page 42 of 313
<u>SR. NO.</u>	<u>PARAMETERS</u>	<u>UNITS</u>	<u>VALUES</u>
	(d) K as CaCO ₃	ppm	10
	Total Cation	ppm	585
15.0	ANIONS		
	(a) HCO ₃ as CaCO ₃	ppm	400
	(b) Chlorides	ppm	149
	(c) SO ₄ as CaCO ₃	ppm	33
	(d) Fluoride as CaCO ₃	ppm	1
	(e) Nitrate as NO ₃	ppm	2
	Total Anion	ppm	585
16.0	Ammonia	ppm	Absent - Traces
17.0	Silica Colloidal (as SiO ₂)	ppm	< 1 (can be present in summer)
18.0	Silica Non - Colloidal (as SiO ₂)	ppm	36
19.0	Free Chlorine	ppm	Nil
20.0	Total Suspended Solids	ppm	Not Available
21.0	Carbonates as CaCO ₃	ppm	Not Available
22.0	Boron	ppm	<1 ppm
23.0	Oil & Grease	ppm	Not Available

**1X660MW BHUSAWAL TPS-UNIT:6
MAHARASHTRA, INDIA.**

CLARIFIED WATER ANALYSIS

ANNEXURE-I

<u>SR. NO.</u>	<u>PARAMETERS</u>	<u>UNITS</u>	<u>VALUES</u>
1.0	pH		8.0 – 8.5
2.0	Temperature	°C	22 - 30
3.0	Conductivity	µS/cm	1300
4.0	Colour	Hazen Units	Not Available
5.0	Odour		Not Available
6.0	Taste		Not Available
7.0	TDS	ppm	870
8.0	P-Alkalinity as CaCO ₃	ppm	Nil
9.0	M-Alkalinity as CaCO ₃	ppm	400
10.0	T – Alkalinity as CaCO ₃	ppm	400
11.0	Organic Matter as KMnO ₄	ppm	50
12.0	Iron (as Fe)	ppm	1
13.0	Turbidity (NTU)	ppm	2 ppm (NTU)
14.0	CATIONS		
	(a) Ca as CaCO ₃	ppm	295
	(b) Mg as CaCO ₃	ppm	77
	(c) Na as CaCO ₃	ppm	203

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume: III-E1
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1		Section-2
REV: R0	WATER TREATMENT SYSTEMS		Page 42 of 313
<u>SR. NO.</u>	<u>PARAMETERS</u>	<u>UNITS</u>	<u>VALUES</u>
	(d) K as CaCO ₃	ppm	10
	Total Cation	ppm	585
15.0	ANIONS		
	(a) HCO ₃ as CaCO ₃	ppm	400
	(b) Chlorides	ppm	149
	(c) SO ₄ as CaCO ₃	ppm	33
	(d) Fluoride as CaCO ₃	ppm	1
	(e) Nitrate as NO ₃	ppm	2
	Total Anion	ppm	585
16.0	Ammonia	ppm	Absent - Traces
17.0	Silica Colloidal (as SiO ₂)	ppm	< 1 (can be present in summer)
18.0	Silica Non - Colloidal (as SiO ₂)	ppm	36
19.0	Free Chlorine	ppm	Nil
20.0	Total Suspended Solids	ppm	Not Available
21.0	Carbonates as CaCO ₃	ppm	Not Available
22.0	Boron	ppm	<1 ppm
23.0	Oil & Grease	ppm	Not Available



TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-415-100-N011**

SECTION: **II**

SUB-SECTION: **IIA**

REV. NO. **00** DATE 10.12.2019

SHEET **1** OF **1**

SUB-SECTION - IIA

STANDARD TECHNICAL SPECIFICATION (MECHANICAL)

- **STANDARD TECHNICAL SPECIFICATION FOR MISC. PUMPS (VERTICAL) INCLUDING DATASHEET-C**
- **STANDARD QUALITY PLANS**



TITLE:

STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS

SPECIFICATION NO. PES-179-07

VOLUME:

SECTION: IIA

REV. NO. 04

DATE: 01/07/2016

SHEET 1 Of 18

1.00.00 GENERAL INFORMATION

- 1.01.0 The general guidelines as illustrated in the subsequent clauses of this section shall be applicable for vertical pumps to be procured under the scope of this package.
- 1.02.0 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship, and shall be capable of performing the required duties in a manner acceptable to Engineer/Owner who will interpret the meaning of drawings and specifications and shall be entitled to reject any component or material, which in his judgement is not in full accordance herewith.
- 1.03.0 The omission of specific reference to any component/accessory necessary for the proper performance of Miscellaneous Pumps and drives shall not relieve the bidder of the responsibility of providing such facilities to complete the supply of equipment at quoted prices.
- 1.04.0 BHEL's / Customer's representative shall be given full access to the shop in which the equipment are being manufactured or tested and all test records shall be made available to him.
- 1.05.0 The equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and shipping release issued by BHEL/Customer.

2.00.00 CODES AND STANDARDS

- 2.01.00 In addition to the requirements spelt out elsewhere in the specification, the equipment to be provided under this section shall specifically conform to the following codes, standards, specifications and regulations, as applicable, including all the latest amendments subsequent to the year of publication as mentioned below.
- 2.01.01 IS-1710/1989: Vertical Turbine Pumps for Clear, Cold and Fresh Water.
- 2.01.02 IS-5120/1977: Technical requirements for Rotodynamic special purpose pumps.
- 2.01.03 IS-5639/1970: Pumps for handling chemicals & corrosive liquids.
- 2.01.04 IS-5659/1970: Pumps for process water.
- 2.01.05 IS-6536/1972: Pumps for handling volatile liquids.
- 2.01.06 IS-9137/1978: Code for acceptance tests for centrifugal, mixed flow and axial flow pumps- Class 'C'.

	TITLE: STANDARD TECHNICAL SPECIFICATION VERTICAL PUMPS		SPECIFICATION NO. PES-179-07	
			VOLUME:	
			SECTION: IIA	
			REV. NO. 04	DATE: 01/07/2016
			SHEET 2 of 18	
2.01.07	BS 5316	Acceptance tests for Centrifugal, mixed flow Part-I/1976 and axial flow pumps - Class 'C' Tests (ISO 2548/1973)		
2.01.08	BS 5316	Acceptance tests for Centrifugal, mixed flow Part-II/1977 and axial flow pumps - Class 'B' Tests (ISO 3555/1977)		
2.01.09	ANSI B 73.2M 1984	Vertical inline centrifugal pumps for chemical process		
2.01.10	API-610/1989:	Centrifugal pumps for general refinery services.		
2.01.11	HIS	Hydraulic Institute Standards, USA		
2.01.12	PTC 8.2/1965:	Power Test Codes - Centrifugal pumps.		
2.01.13	ASTM-1-165-55	Standard Methods for Liquid Penetration Inspection.		
2.02.00	In case of any contradiction with the above standards and annexure, the stipulations in the annexure shall prevail and shall be binding on the bidder.			
3.00.00	SCOPE OF SUPPLY & SERVICES:			
3.01.00	The miscellaneous pumps and drives scope shall be as specified in Data Sheet-A /Section IA.			
3.02.00	The Capacity, Head, Materials of construction and other particulars of pumps are detailed in Data Sheet-A of the specification.			
3.03.00	Accessories:			
	All the pumps under this specification shall be complete with following standard/special accessories.			
3.03.01	Standard accessories:			
	a)	LT Electric drives/motors (as applicable) with cable gland and lugs at motor end. (The bare HT drive motors and LT motors not in bidder's scope of supply, wherever required supplied as free issue by BHEL refer Cl. 5.08.00).		
	b)	Pump motor coupling along with coupling guard.		
	c)	Common base/sole plate for pumps and motor.		
	d)	Thrust block assembly (Thrust pads, attachments) for transferring the pump thrust to concrete thrust block (concrete thrust block in purchaser scope), as per clause 5.23.00.		

	TITLE: STANDARD TECHNICAL SPECIFICATION VERTICAL PUMPS	SPECIFICATION NO. PES-179-07	
		VOLUME:	
		SECTION: IIA	
		REV. NO. 04	DATE: 01/07/2016
		SHEET 3 of 18	
e) Thrust bearing temperature measurement devise to be provided. f) Self contained lubrication system along with all internal piping, valves, fittings, specialties etc. as required. g) Counter flanges for suction/ discharge nozzles along with fixing nuts, bolts and gaskets. h) Anchor bolts, nuts, seating steel works, shims etc. as necessary for mounting the pump-motor unit on Civil foundations. i) Suitable vent (with valves)/ lifting/ handling attachments for the pump/ motor/ accessories. j) Suitable drain connections with isolating valves as applicable. k) Supply of first fill of lubricants with toping requirements for one year of operation after commissioning and handing over of equipment. l) Set of "Special" Tools & Tackles for Pumps and motors, if any. m) Erection and commissioning spares, "on as required" basis. n) Bidder shall provide various drawings, data, calculations, test reports/ certificates, operation and maintenance manuals, As-built drawings, etc. as specified and as necessary. o) Mandatory spares as specified in respective Data Sheet-A of this section. 3.04.00 Services included in Bidder's Scope: 3.04.01 The pumps shall be guaranteed to meet the performance requirements specified vide Data Sheet -A and also for trouble free operation after commissioning. Schedule of performance guarantees (Section-IIIA) duly filled and signed shall be furnished with the bid. 3.04.02 The pumps erected by the purchaser shall be checked by the bidder for correctness of their installation, alignment, etc. at site prior to their commissioning. 3.04.03 After commissioning of pumps at site, site performance test for Noise, vibration and parallel running of pumps of all pumps for each unit/project shall be conducted by pump vendor at project site to ensure that the pumps meet the specified requirements. Pump vendor shall bring necessary instruments for conductance of site performance test. If the site performance is found not meeting the requirements in any respect as specified, then the equipment shall be rectified or replaced by the vendor, without any commercial implication to BHEL.			



TITLE:

STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS

SPECIFICATION NO. PES-179-07

VOLUME:

SECTION: IIA

REV. NO. 04

DATE: 01/07/2016

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Note: Applicability of conducting PG test at site by vendor as per above clause shall be applicable if indicated in Section-1A.

If conductance of PG test of pumps at site for Noise, vibration and parallel running of pumps of all pumps for each unit/project is not in bidders scope and same is conducted by BHEL/ customer. In such cases also, if the site performance is found not meeting the requirements in any respect as specified, then the equipment shall be rectified or replaced by the vendor, without any commercial implication to BHEL.

3.04.04 Performance Guarantees for pumps shall stand valid till the satisfactory completion of performance testing by BHEL and its acceptance by purchaser / customer.

3.05.00 Works excluded from Bidder's Scope:

- a) All HT motors and those LT Motors which are specifically excluded
- b) Civil foundation
- c) Suction/ discharge pipe works
- d) MCC/ Switchgear/Power supply
- e) Power and Control Cables, unless specifically specified in Electrical/ Systems portion of the specification.
- f) Erection of equipments.

4.00.00 BID EVALUATION CRITERIA & LIQUIDATED DAMAGES FOR SHORTFALL:

4.01.00 The bids received shall be evaluated for power consumption at inlet to the motors, in respect of pumps specified in Data Sheet-A (working pump only viz. not the standby), for the purpose of price comparisons as briefed below:

The bid evaluation shall be done at the rate as specified in Data Sheet A per one (1) KW Power consumption, per working pump as follows.

$$\text{KW} = \frac{Q \times H \times S}{P \times M \times 367.2}$$

Where Q = Rated capacity M³/hr
H = Rated TDH, MWC
P = Pump Efficiency
M = Motor Efficiency.
S = Specific Gravity of fluid handled

4.02.00 The efficiencies for pumps and motors for arriving at benchmark power for Bid Evaluation shall be as indicated in Data Sheet A for various pumps.

No advantage shall be given to the bidder for Aux. Power quoted lower than the Bench mark values calculated with KW calculation formula at Cl. 4.01.00 above, *considering the bid evaluation efficiencies for pump and motor as indicated in Data Sheet-A.* However the



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bids shall be evaluated as above if the Aux. Power quoted are higher than Bench mark values.

NOTE:

1. Efficiencies for HT motors and LT motors not in bidder's scope, for bid evaluation purpose shall be taken based on the maximum value as furnished in Data Sheet A.
2. During contract stage the Guaranteed power consumption of Pumps with BHEL supplied drives (HT/LT) for successful bidder shall be reworked by BHEL as below:

Revised guarantee power consumption shall be as per KW calculation formula at Cl. 4.01.00 above, where P = pump efficiency guaranteed by bidder and M = motor efficiency as per approved datasheet of the supplied HT/LT motor.

4.03.00 Liquidated damages for shortfall in Guaranteed KW

The above guaranteed power consumption shall be demonstrated by the successful bidder during performance testing at works/ site.

For pumps with BHEL supplied drives, the power consumption shall be compared with the reworked guarantee power consumption, defined as per note no. 2 of Cl. 4.02.00 above for the purpose of shortfall.

The liquidated damages @ twice the bid evaluation rate as above per KW per working pump shall be levied in the event of failure of bidder to demonstrate the guaranteed power consumption.

5.00.00 TECHNICAL REQUIREMENTS:

5.01.00 The pumps shall meet the technical requirements of Section-I as well as Section-II. In the event of any contradiction of Section-II with Section-I, the Section-I will prevail.

5.02.00 The pumps shall be Electric motor driven.

5.03.00 The Pumps shall conform to HIS. It is bare minimum requirement, however, any other equivalent or stringent standard is also acceptable, if, all the requirements of HIS are also met.

5.04.00 The type of Vertical pumps shall be as follows (if specifically not indicated otherwise in Data Sheet-A):
a) Vertical turbine type pumps with 1500rpm. (if no. of stages ≤ 5) shall be preferred.
b) If stages of vertical turbine pumps are more than 5, then sump pump construction shall be preferred with 1500 rpm speeds.
c) For pumps with maximum speed 3000rpm, sump pump construction is also acceptable.

5.05.00 No negative tolerance shall be permitted in rated capacity & TDH.

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5.06.00	No negative tolerance shall be permitted in efficiency at rated capacity.		
5.07.00	The shut off head of pumps shall be more than pump rated TDH and percentage variation may vary depending on the specific speed of the pump as under: i. 10-15% for pumps of specific speed up to 1000 US units, ii. 15-20% for pumps of specific speed in the range of 1000 to 2000 US units, iii. 20-40% for pumps of specific speed in the range of 2000 to 4000 US units, iv. Above 50% for pumps of specific speed in the range of 4000 to 7000 US units.		
5.08.00	All HT motors and those LT motors which are not in bidder's scope of supply: bare motors only, shall be supplied as free issue by BHEL through BHEL, based on ratings and TS (Torque - Speed) curve selected and furnished by the bidders along with their un-priced bid. The responsibility for satisfactory operation for combined performance of pumps & motors shall rest with the bidder only as if, the drive motors also have been supplied by the bidder. Couplings, base plate, foundation bolts, any other fittings, etc. as required shall be supplied by the bidders only. BHEL shall supply one number of each type of drive motors (where drive motor is not in bidder's scope of supply) for shop testing of pumps with job motors. All other motors shall be dispatched by BHEL directly to project sites.		
5.09.00	For all HT motor driven pumps, BHEL has envisaged vibration-monitoring system in their own scope. The bidder shall make provisions for mounting following on the pump/ pump shaft: • Purchaser's probes in both DE/NDE bearings of pumps • Key slots on pump shaft and flat surface on bearing housing for mounting vibration measuring block with dimensions as specified in Data Sheet A. • Other components as finalized during detailing. • For mounting of above on the HT motors & specifically excluded LT motors, same shall be taken care by BHEL.		
5.10.00	The pumps shall be capable of developing the required total head at rated capacity for continuous operation. The pumps shall operate satisfactorily at any point on the Q-H characteristic curve over a range of 0% to 130% capacity and shall be suitable for continuous operation between 30% to 130% capacity.		
5.11.00	Selection of the pumps shall be such that the design point shall be met even with negative manufacturing tolerance.		
5.12.00	The total head capacity curve shall be continuously rising towards the shut off, the pumps shall preferably be non-overloading type and stable.		
5.13.00	The pumps shall be capable of running over the entire range of submergence/ NPSH requirement conditions required without any noise, vibration or cavitations.		

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	The prevailing suction pressures for various pumps are indicated in Data Sheet-A for suitable mechanical design of pumps.		
5.14.00	The pumps shall be of stiff shaft design. The minimum internal clearances should be sufficiently more than the max. static deflection of the shaft. Shaft size selected must take into consideration the critical speed as specified in API-610.		
5.15.00	Pumps and motors shall run smooth without undue noise and vibration.		
	The vibration shall be within vibration norms for testing as per American National Standard for 'Rotodynamics Pump' for Vibration Measurement and allowable values, Doc. ANSI/ HIS 9.6.4-2009. The applicable vibration limits for each pump, shall be indicated in the Technical Data sheet to be furnished by the successful bidder after award of LOI/ PO.		
	The noise level shall be limited to 85 dB at distance of 1.0M.		
5.16.00	Pumps of a particular category shall be identical and shall be suitable for parallel operation with equal load division. Components of identical pumps shall be interchangeable.		
5.17.00	After installation, the guaranteed values of noise, vibration and parallel operation of pumps shall be tested and verified. If the site performance is found not meeting the requirements in any respect as specified, then the equipment shall be rectified or replaced by the vendor, at his own cost.		
5.18.00	High reliability of the pumps is an essential requirement and therefore it gets weightage over its efficiency. It is therefore essential that the bidder choose a standard proven model from the range of pumps manufactured.		
5.19.00	The offered pumps shall be of proven design meeting the experience-qualifying requirement of their operation at two sites for a minimum period of one year or as specified in technical PQR. Any deviation to this criterion shall be suitably highlighted in the deviations schedule.		
5.20.00	The bearings shall be self-water lubricated, no external water supply shall be available. The cooling/ lubrication water for bearings, etc. shall be tapped from the pump discharge and supplied thru' bidder's integral pipe work.		
5.21.00	<u>If water handled by pump is sea water/ dirty/ not suitable for lubrication/ cooling:</u>		
5.21.01	The bearing lubrication/cooling may be specifically reviewed by bidders for the suitability with water analysis enclosed with Data Sheet-A of this section.		
	These pumps shall necessarily be provided with Thordan type line shaft bearings even if the other type of bearings are claimed suitable by the manufacturers.		



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The bidder's shall satisfactorily establish the adequacy of self water lubrication if provided, for similar rating pumps installed for the duty condition in the event of order. In absence of adequate documentary evidence to the satisfaction level of BHEL, the bidder shall provide force water lubrication as per clause 5.21.02 below without any cost implication.

5.21.02

In the event, the forced water lubrication is envisaged by the bidder, the following minimum requirements shall be complied with further details subject to Purchaser's approval during detailed engineering after the award of order.

One set of common water lubrication system shall be provided separately for each type of pumps. The lubricating system shall provide continuous lubrication to all the pumps during operation and the minimum requirements shall be as follows:

- 2X100 % duty self cleaning strainers of suitable size and mesh opening shall be installed on the common pump discharge and outlet shall be led to 1 no. 6 hrs. storage or min. 10 M3 capacity tank of carbon steel MOC, to be placed on roof of pump house .
- 2X100 % duty horizontal centrifugal lubricating pumps with TDH more than the shut off head of the subject pumps shall be provided. The capacity of each pump shall be sufficient to lubricate all of the subject pumps including 10% margin on capacity and head to suit requirement with 10 % margin with head.
- These horizontal pumps shall take suction from the overhead Sintex tank as explained above.
- Associated piping, fittings, Tank inlet motor operated valve, lubricating pumps suction & discharge isolating valves, motorised/ solenoid valves (as per purchaser's approval), lubricating pumps discharge check valves and lubricating pipe isolating valve at inlet to each of subject pump, etc. as required shall be provided.
- Instrumentation – Level Gauge, high level & low level switches for tank, pressure gauges at suction & discharge of each lubricating water pumps, low pressure switch on lubricating pipe at inlet to each of subject pump for subject pump start interlock, pressure switch on lubricating pipe at common discharge of subject pump for start up of stand by pump etc., as required subject to purchaser's approval shall be provided.



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- Bidder shall supply any other equipment/ instrument required for proper functioning of the lubricating system, as deemed necessary during contract without any price implication to BHEL.
- Bidder shall also provide a relay based local control panel for proper functioning of the above system. The system shall be suitable for fully automatic operation as per approved write-up during detailed stage.
- Subject pumps shall be provided with shaft enclosing tube in the event above Lubrication system is envisaged by bidder. MOC for shaft enclosing tube shall be equivalent/ superior to MOC for column pipe for subject pump.

The complete forced water lubrication as above – if applicable, shall be in bidder's scope. Bidder to inform in schedule of deviation at bid submission stage, if fresh water is required for forced water lubrication system.

5.22.00 For Vertical pumps no thrust block is being provided except for pumps of projects, specified in Sec-IA of this specification. Bidder to design the pump foundation system (base plate/ sole plate, discharge head, foundation bolts etc.) capable of transferring the pump thrust to the concrete pump foundation itself.

5.23.00 If specified in Sec-IA of specification, thrust block assembly (Thrust pads, attachments) for transferring the pump thrust to concrete thrust block (concrete thrust block in purchaser scope) to be provided by bidder.

6.00.00 MANDATORY SPARES:

6.01.00 Bidder to provide the Mandatory spares listed vide Data Sheet-A. Unit price of mandatory spares shall be furnished in price Schedule.

6.02.00 Bidder shall include the cost of Mandatory Spares, unless specified otherwise in Sec-IA of the specification or NIT.

7.00.00 OTHER REQUIREMENTS:

7.01.00 The quality of water handled by various pumps shall be as per Data Sheet-A.

7.02.00 The materials of construction for various components specified are the minimum requirements and materials of construction for other components not specified shall be similarly selected by the bidder for the intended duty.

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7.03.00	The makes of various bought out items of bidder (i.e. motor, bearings etc.) shall be subject to purchaser's approval in the event of order.		
7.04.00	Painting for Pumps		
	a) The surface of SS, Gun metal, brass, bronze and non-metallic component shall not be applied with any painting.		
	b) The Steel surface to be applied with painting shall be thoroughly cleaned before applying painting by brushing, shop blasting etc. as per the agreed procedure.		
	c) For all the steel surfaces inside the (indoor installation) building, a coat of red oxide primes of min. thickness DFT of 50 microns followed up with under coat of Synthetic Enamel paint of min. thickness DFT of 50 microns shall be applied. The top coat shall consist of two coats each of min. thickness DFT of 50 microns of synthetic enamel paint and thus total DFT shall be min. 200 microns.		
	d) For all the steel surfaces exposed to (outdoor installation) atmosphere, a coat of chlorinated rubber based zinc phosphate primer of min. thickness DFT of 50 microns followed up with under coat of chlorinated rubber paint of min. thickness DFT of 50 microns shall be applied. Then, intermediate coat consisting of one coat of chlorinated rubber based paint pigmented with Titanium di-oxide with min. thickness DFT of 50 microns and top coat shall consist of two coats each of min. thickness DFT of 50 microns of chlorinated rubber paint shall be provided. Total DFT of paint system shall be min. 200 microns.		
7.05.00	It is mandatory for the bidder to submit along with the bid, the deviations if any – whether major or minor in the schedule of deviations only. In the absence of deviations listed in the “Schedule of deviations, the offer shall be deemed to be full conformity with the specification, “not-withstanding” anything else stated elsewhere in bidder’s offer. The implied/indirect deviations shall not be binding on the purchaser.		
8.00.00	PERFORMANCE REQUIREMENTS		
8.01.00	Performance requirements for the pumps shall be as guided in Data sheet - A enclosed with Section-I.		
8.02.00	Pump(s) shall preferably be designed to have the best efficiency at flow within ± 10% of the specified duty point flow. The pumps shall be suitable for continuous operation at any point within the “Range of Operation” as stipulated in the Data Sheet - A attached with Section-I.		

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8.03.00	Pump(s) shall preferably have a continuously rising head-capacity characteristics from the specified duty point towards shut-off point, the maximum being at shut-off to enable parallel operation. Under all circumstances, the 'range of operation' of the pumps shall exclude any unstable operating zone of the head-capacity curve.		
8.04.00	Wherever specified in the Data Sheet - A, pumps of each category shall be suitable for parallel operation. The head vs. capacity, the BHP vs. capacity characteristics etc. shall be identical to ensure equal load sharing and trouble-free operation of any pump when the other pump(s) working in parallel with it trip.		
8.05.00	The pump set along with drive motor shall run smooth without undue noise and vibration. Acceptable vibration limits shall be guided by the HIS of USA. Refer clause 5.15.00 above for permissible limits.		
9.00.00	DESIGN AND CONSTRUCTION		
	Pumps shall be of vertical shaft, complete with bowl, column pipe, discharge head and base plate with all accessories. General design and constructional features of the pumps shall be as follows:		
9.01.00	Bowl Assembly		
9.01.01	This will be either a single or multi-stage centrifugal, mixed flow or axial flow type with discharge co-axial with shaft. Type of impeller shall be chosen on the basis of the pump specific speed and the characteristics of handling fluid.		
9.01.02	Pumps (s) shall have provision for adjustment of impellers in vertical direction from an accessible location, preferably at the housing (where separate thrust bearing for the pump is provided). The adjustment mechanism must take into consideration the extension of the line shaft due to hydraulic down thrust, weight of the shaft and impeller.		
9.02.00	Discharge Head		
9.02.01	Pump (s) shall have above/below floor discharge, as specified in the Data Sheet-A, attached to this section.		
9.03.00	Column pipe		
9.03.01	Column pipe shall be flanged and of bolted connection. Column pipes shall be designed for full internal vacuum.		
9.03.02	In case of multi-piece column pipe and shaft assembly, the design shall permit raising/lowering of the pump assembly piece by piece without any difficulty. Any fixtures, clamps, etc. necessary for such purpose shall be supplied by the Bidder under this section.		



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The bidder shall also submit a write-up describing clearly the procedure of handling the pump.

9.04.00 Impeller shaft, line shaft and head shaft

9.04.01 Shaft size shall be selected on the basis of maximum torque to be applied on the pump shaft.

The critical speed shall be at least 30% higher than the rated speed.

9.04.02 Impeller shaft shall be guided by bearings provided in each bowl or above and below the impeller shaft assembly. The butting faces of the shaft shall be machined square to the assembly and the shaft shall chamfered at the edges.

9.04.03 Line shaft may be single or multiple pieces as required. In case of multiple pieces, line shaft shall be coupled as per the standard practice of the manufacture. For screwed coupling, directions shall permit tightening of the joint during pump operation.

9.04.04 Replaceable shaft sleeves shall be furnished at applicable location, particularly under stuffing box and at other locations, as considered necessary.

9.05.00 Shaft enclosing tube

Shaft enclosing tube shall be required, unless self lubricated (and cooled) type of shaft bearings are asked for. Length of the shaft enclosing tube shall be in conformity with the shaft piece lengths.

9.06.00 Seal rings

Replaceable seal/wear rings both on impeller and on casing shall be provided in case it is asked for in this specification.

9.07.00 Bearings

9.07.01 Shaft bearings

Adequate number of properly designed bearings shall be provided for smooth and trouble free operation of the pump. Number of bearings shall consider the number of shaft pieces used and the critical speed of the shaft. Bearings shall be either lubricated by external clear water/oil/grease or self lubricated as specified in the Data Sheet-A of this section.

In case of external water/oil lubrication, complete lubrication arrangement shall be furnished with the pump. In case of forced water lubrication of the shaft bearings, the system and other accessories shall be in the scope of supply of Bidder as per clause 5.21.02.

9.07.02 Thrust Bearing



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Thrust bearing of adequate size and capacity shall be provided to take the vertical thrust of the impeller arising out of the pump operation and dead weight of the rotating components. Life of the thrust bearing shall be guided by the design standard of the pump. Thrust bearing shall be capable of running continuously at maximum load.

Thrust bearing shall be either grease or oil lubricated. Lubrication arrangement shall be such that the lubricant does not contaminate the handling fluid. The arrangement shall also be adequate to protect the bearing, while the pump coast down to stop in case of power failure of the station. Pre-lubrication of the thrust bearing, if recommended by the pump manufacturer, shall be taken care of in designing the lubrication system.

For thrust bearing, provision for temperature measurement shall be provided.

Cooling of the thrust bearing, if necessary, shall be done by the handling fluid/external water, depending on the fluid handled.

Location of the thrust bearing may be at the pump body or at the driver, or at both depending on the requirement indicated in this specifications or as per the recommendation of the pump manufacturer (and approved by Purchaser).

9.07.03 Bearings of reputed makes are to be provided, same shall be indicated in Technical Data sheet to be furnished by the successful bidder after award of LOI/ PO, subject to acceptance of BHEL/ end customer, without any price implication to BHEL.

9.08.00 **Reverse Rotation**

9.08.01 If indicated at Section-IA of the specification, the pump impeller and other rotating components shall be designed for reverse rotation, when subject to reverse flow at rated pump discharge head.

9.09.00 **Drive Unit**

9.09.01 The pumps shall be driven by electric motor directly coupled as specified in the Data Sheet-A of this section. A heavy duty coupling along with coupling guard shall be provided between the pump and drive unit.

9.09.02 Unless otherwise specified in Data Sheet-A of this section, drive unit power rating shall be the maximum of the following requirements.

- 16% margin over the pump shaft input power at the rated duty point.
- 10% margin over the maximum pump shaft input power required within the 'Range of Operation'.
- Pump shaft input power required considering the overloading of the pump assuming



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single pump operation in the event of tripping of one or more of the pumps operating in parallel.

9.09.03 All Vertical pump motors shall be designed/capable of withstanding max. run away speed during reverse flow through pump.

10.00.00 **INSPECTION AND TESTING**

10.01.00 The Quality Plans enclosed in the specification are for bidder's guidance only. The bidder shall comply with these and other minimum requirements specified in the specification and shall furnish his own quality plan in the event of order based on the guidance given as above, for approval by BHEL/Customer.

10.02.00 The Bidder shall carry out the following specific tests inspections to ensure that the equipment furnished lies in strict conformance with the specification and also in accordance with applicable codes/standards and good engineering practice.

a) **Identification and Testing**

i) All materials used for pump construction shall be of tested quality. Material shall be tested as per the relevant standard and test certificates shall be made available to the Owner. Material identification and testing shall include, but shall not be limited to the following components:

- Bowls and suction bells
- Impeller and wearing rings
- Shafts and shaft sleeves
- Couplings
- Bearings
- Column pipes
- Discharge heads
- Bowl Assembly

ii) 100% PMI (Process Material Identification) inspection for material grade of pump casing, shaft and impeller shall be done by vendor & certification shall be submitted for review of BHEL. Further BHEL reserves the right to conduct random & independent PMI inspection on pump casing, shaft and impeller to ascertain the grade of material during inspection at vendor works.

iii) Tests for each pump included under this section shall include but not be limited to the following:

- The entire surface of the impeller / casing / diffuser castings shall be subjected to Dye Penetration Test as per ASTM Specification no.:1-165-65.



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- Shaft coupling & other active components shall be subjected to Dye Penetration and Ultrasonic Tests.
- Wearing rings, shaft sleeves shall be subjected to Dye Penetration Test.
- Fabricated components of pumps shall be subjected to Dye Penetration test on weld.
- Verification of material, witnessing of pouring, casting and inspection of finished fabricated/castings.
- Inspection of finished castings for impeller and verification of materials.
- Inspection of pump shaft and verification of material.
- Witnessing of NDT/review of NDT reports.
- Static balancing test for impeller and dynamic balancing of complete rotating parts as per ISO- 1940 to grade 6.3 or better.
- Complete Inspection of assembled pump.

b) Hydraulic Testing

Bowls/ Suction bells, Columns pipe, Discharge head and any other applicable pressure parts shall be hydrostatically tested at maximum of the following:

- i. 2 times the TDH (Total Dynamic Head) at rated capacity (or)
- ii. 1.5 times the shut-off pressure
- iii. System Design pressure indicated in Data Sheet-A of Section-I.

The HT pressure shall be maintained for a period of not less than 30 minutes. During testing there should not be any pressure drop & leakage.

c) Performance Test at Shop

- i) Each pump shall have to be tested to determine the performance curves of the pumps. These tests are to be conducted in presence of Owner's representative as per the requirements of the Standards of Hydraulic Institute of USA (ASME-Power Test Code PTC 8.2/BS-599) or any other equivalent standard.
- ii) Performance tests are to be conducted to cover the entire range of operation of the pumps at rated speed. These shall be carried out to span 130% of rated capacity up to pump shut-off condition. A minimum of five combinations of head and capacity are to be achieved during testing to establish the performance curves, including the design capacity point, shut-off point and the two extremities of the range of operation as specified in the annexure. After

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completion of performance test, all pumps shall be stripped down for inspection of internals. iii) Tests shall be conducted with actual drive motors being furnished. iv) Minimum submergence/ NPSH required tests are to be conducted for each type at 3% head drop conditions, if specified in the pump approved QP. v) All rotating components of the pumps shall be subjected to static and dynamic balancing tests. The assembled rotor will be subjected to dynamic balancing tests. vi) Mechanical run test shall be carried out on all pumps to determine the vibration levels, noise levels etc. This test shall be conducted at site also. However, test value at site shall be used for the acceptance of the equipment.			
10.03.00	Inspection of Mandatory/ Recommended spares shall be in line with approved QP for main supply.		
11.00.00	DRAWINGS/ DOCUMENTS DISTRIBUTION SCHEDULE		
11.01.00	After award of LOI, the successful bidder shall submit drawings/documents as per Data Sheet-C.		
11.02.00	The no. of drawings/documents to be submitted shall be as per Data Sheet-C.		
12.00.00	The various Sections-I's & II's along with Data Sheets attached in this specification together with the specification for Miscellaneous Pumps shall be complied with by the bidders.		
13.00.00	Bidder to submit all drawing/ documents in soft as well as hard copy in the event of order as per schedule indicated in section-IA.		
	Within one (1) week of receipt of BHEL comments a technical representative from Bidder's works shall come for meeting with BHEL along with revised documents to resolve all issues and incorporate all comments in the soft copy for further submission to customer. Further on receipt of customer's comments on the documents a technical representative from Bidder's works shall come for meeting with Customer to resolve all issues and incorporate all comments in the soft copy and further resubmission of same to Customer. The representative shall be available here till category I approval of all the drawings and documents.		
14.00.00	Guarantee for all pumps shall at least remain valid for 18 months from the Unit commissioning date or as specified in NIT.		



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15.00.00 The following documents only shall be furnished by the bidder with his offer:

- a) Compliance certificate duly signed and stamped (enclosed at Section-IIIB).
- b) GA drawings of pumps and motors with following: (shall be only for reference purpose, same shall not be reviewed/commented by purchaser at this stage and shall be subject to approval only during contract).
 - Civil static & dynamic loads.
 - Foundation details.
 - Minimum Submergence required.
 - Clearances - Side, Back & Bottom
 - Min. Recommended crane capacity
- c) Guarantee Schedule duly signed and stamped (enclosed at Section-IIIA).
- d) Technical deviation schedule (if reqd.) (enclosed at Section-IIIC).
- e) Data for drive Motor (HT/LT- which is not in bidder's scope of supply - as applicable):
Load torque speed curves of the pumps, selected motor rating, rpm, GD^2 of driven equipment.
- f) Unpriced copy of the price bid shall be furnished along with the technical bid.

Apart from above no other Drgs./Docs./Data sheets etc. are required to be submitted at bid stage and even if furnished shall not be taken cognizance of.

In case of any deviation from this technical specification, the same shall be indicated in the schedule of deviations as per Section-IIIC or NIT. In the absence of duly filled schedules it will be assumed that the bid strictly conforms to the specification.



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Drawings / documents distribution schedule to be followed by successful Bidder:

1.0 Drawings/documents submission schedule, shall be as per Section-IA.

The successful bidder shall submit at least following drawings/ documents:

1.1 Fully dimensioned outline general arrangement drawings of the pump and motor assembly. This drawing should include foundation base plate/sole plate details as applicable, civil foundation, anchor bolt details, loading data (Static and Dynamic), points of connections of external piping, cables and mounting of devices furnished by the supplier and details for Gap between Coupling Shafts, Float & details for axial/radial tolerance allowed etc. which are required for erecting agency during erection of pump.

1.2 Cross sectional drawing of the equipment showing the details of assembly of components and their material of construction with standard applicable codes.

1.3 Technical datasheet as per Datasheet-B (Section-IIID) including characteristic curves of pumps showing the following:

- a) Flow Vs Head
- b) Flow Vs Power
- c) Flow Vs Efficiency
- d) Flow Vs NPSHR/ minimum submergence

1.4 QAP for pump and QAP for motors (if applicable).

1.5 GA, Datasheet, Curves etc. for drive motor (as applicable).

1.6 Operation and maintenance manual.

1.7 Lubrication arrangement drawings for external lubrication (if applicable).

1.8 PG test procedure as per clause 3.04.03 (if applicable).

1.9 Motor type test document (if applicable).

1.10 Test Procedure for Sump Model Study (if applicable).

2.0 Within the stipulated time period as per vendor's drawings/ documents schedule as per NIT, the O&M Manual comprising of minimum following shall be submitted:

- a) Drawings of components & details as deemed necessary.
- b) Instruction manual for erection, operation & maintenance.
- c) Storage instruction.

3.0 Before dispatch of the equipment the bidder shall furnish the following.

- a) Material test certificates.
- b) Shop test reports & certificates.
- c) Fulfilment of packing instructions as indicated in Section-IA of this specification.

4.0 Distribution of drawings / documents for all projects:

The no. of copies of drawing/ documents to be submitted by the successful bidder, after the award of the contract shall be as per Section-IA or as specified in NIT.



BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN

Rev-01

QUALITY PLAN FOR MISCELLANEOUS PUMPS				CUSTOMER		PROJECT TITLE						
				BIDDER/VENDOR		QUALITY PLAN NUMBER		PE-QP-999-100-N004 (For Hor. Pumps) PE-QP-999-100-N004 (For Ver. Pumps)				
SHEET 1 OF 6				SYSTEM		ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL)						
S. No.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1	MATERIALS CONTROL											
1.1	CASINGS (INCLUDING BOWLS, DIFFUSERS, STAGE BODIES, DISCH HEAD (IF CAST)), ETC. - (AS APPLICABLE) AND IMPELLER	MECHANICAL AND CHEMICAL PROPS	CR	MECHANICAL AND CHEM. ANALYSIS	ONE/HEAT/BATCH	APPROVED CS DRAWING/DATA SHEET	RELEVANT MATERIAL SPECN.	LAB REPORT/ MTC	3/2.		2,1	
1.2	STUFFING BOX, SUCTION BELL, WEARING RINGS, NECK RINGS, SHAFT SLEEVES	DO-	MA	MECHANICAL AND CHEM. ANALYSIS	ONE/HEAT/BATCH	APPROVED CS DRAWING/DATA SHEET	RELEVANT MATERIAL SPECN.	LAB REPORT/ MTC	3/2.		2,1	
		HARDNESS DIFFERENCE BETWEEN CASING / IMPELLER AND WEARING RING	MA	LAB. TEST	100%	APPROVED CS DRAWING/DATA SHEET	50 BHN MIN.	LAB. REPORT	3/2.		2,1	
1.3	BARS/FORGINGS FOR SHAFTS, LINE SHAFTS	1. PHYSICAL & CHEMICAL PROPS	CR	1. MECHANICAL & CHEMICAL ANALYSIS.	1/CAST OR 1/BARS	APPROVED CS DRAWING/DATA SHEET	RELEVANT MATERIAL SPECN.	MILL T.C. OR LAB. REPORT	3/2.		2,1	CORRELATION REQUIRED, IDENTIFICATION AS PER TC
		2. DIMENSIONS	CR	2. MEASUREMENT	100%	MFR. DRAWING	MFR. DRAWING	INSP. REPORT	3/2.		2,1	
		3. INTERNAL DEFECTS FOR 40MM & ABOVE DIA SHAFTS.	CR	3. ULTRA SONIC TEST	100%	ASTMA388 BACK WALL ECHO 100%	DEFECT ECHO MAX 20% OF B.W.E. LOSS OF BACK WALL ECHO 20% MAX	NDT CERTIFICATE	3/2.		2,1	
1.4	STRESS RELIEVING/ HEAT TREATMENT OF CASTING OF ALL ABOVE (IF APPLICABLE) / SOLUTION ANNEALING OF SS CASTING	1. VERIFICATION OF HT CHART	MA	VERIFICATION OF SR/HT CHART	ALL BATCHES	RELEVANT MATERIAL SPECN.	DO-	CORRELATED SR/HT. CHARTS	3/2.		2,1	
		2. IGC TEST FOR SS CASTING	MA	LAB. TEST	ONE SAMPLE/ HT BATCH	ASTM A 262	ASTM A 262 Gr A	LAB. REPORT	3/2.		2,1	
1.5	SHAFT ENCLOSING TUBES, COLUMN PIPES & DISCHARGE ELBOW	1. MECHANICAL & CHEMICAL PROPS. 2. DIMENSIONS. 3. SURFACE FINISH	MA	1. MECH & CHEM TEST 2. MEASUREMENT 3. VISUAL EXAM	1/BATCH 100% 100%	APPROVED GA DRG./DATA SHEET	RELEVANT MATERIAL SPECN./MAFG./ APPROVED DOCS	MFR T.C OR LAB. REPORT	3/2.		2,1	
BHEL				PARTICULARS			BIDDER / VENDOR					
				NAME								
				SIGNATURE								
				DATE						BIDDER/VENDOR SEAL		

NAME SIGN. DATE	Prepared By AJAY JAIN <i>Ajay</i> 23-07-2012	Reviewed By ASHWANI KHANNA <i>Ashwani</i> 23-07-2012	Approved By I. J. SINGH <i>I. J. Singh</i> 23-07-2012
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BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN

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QUALITY PLAN FOR MISCELLANEOUS PUMPS				CUSTOMER		PROJECT TITLE						
				BIDDER/VENDOR		QUALITY PLAN NUMBER						
SHEET 2 OF 6				SYSTEM		ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL)						
S. No.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE/METHOD OF CHECKED	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.6	PLATE FLANGE, C/FLANGE	1. MECHANICAL & CHEMICAL PROS. 2. DIMENSIONS. 3. SURFACE FINISH	MA	1. MECH & CHEM TEST 2. MEASUREMENT 3. VISUAL EXAM	1/CAST 100% 100%	APPROVED GA DRG./DATA SHEET	RELEVANT MATERIAL SPECN./ MFR. DRG./ APPROVED DOC	MILL TC/ LAB REPORT	3/2.		2,1	CORRELATION REQ. FOR MAT OTHER THAN IS 2062
1.7	SUCTION STRAINER (IF APPLICABLE)	MECHANICAL & CHEMICAL PROS.	MI	MECH. & CHEMICAL TEST	1/HEAT	APPROVED GA DRG./DATA SHEET	RELEVANT MATERIAL SPECN./ MFR. DRG./ APPROVED DOC	MILL TC/ LAB REPORT	3/2.		2,1	
1.8	MECHANICAL SEAL (IF APPLICABLE)	TYPE, SIZE, MFRS, NO., MAKE	MA	VISUAL EXAM	100%	APPROVED DATASHEET / GA MECH. SEAL	APPROVED DATASHEET		3/2.		2,1	COMPLIANCE TC FOR APPROVED MAKE
1.9	PUMP BEARINGS	TYPE, SIZE, MFRS, NO., MAKE	MA	VISUAL EXAM	100%	APPROVED DATASHEET	APPROVED DATASHEET		3/2.		2,1	COMPLIANCE TC FOR APPROVED MAKE
2.0 IN PROCESS CONTROL												
2.1	ALL COMPONENTS UNDER 1.00 ABOVE	VISUAL DEFECTS, DIMENSIONS	MA	VISUAL EXAM, MEASUREMENT	100%	MFG. DRAWING	MFG. DRAWING	COMPLIANCE TC	3/2.		2,1	
2.2	IMPELLER	CLEANING AND DEBURRING	MA	VISUAL	100%	MFG. DRAWING	MFG. DRAWING		3/2.		2,1	
	IMPELLER	DYNAMIC BALANCING	CR	DYNAMIC BALANCING	100%	ISO 1940	ISO1940 Gr 6.3	BALANCING CERTIFICATE	3/2.	2,1		WITNESSING ONLY FOR SIZE GREATER THAN 10KW
2.3	IMPELLER-ALL ACCESSIBLE SURFACES, DIFFUSERS	DP TEST	MA	DP TEST ON M/CED AREA	100%	APPENDIX 8 OF ASME SEC. VIII DIV. 1		NDT CERTIFICATE	3/2.	2,1		WITNESS BY BHEL & VERIFICATION BY CUSTOMER
2.4	WEARING RING, SHAFT SLEEVES, CASING	DP TEST	MA	DP TEST ON M/CED AREA	100%	APPENDIX 8 OF ASME SEC. VIII DIV. 1		NDT CERTIFICATE	3/2.		2,1	
2.5	SHAFT	DP TEST	MA	DP TEST ON M/CED AREA	100%	ASTM E 165	NO RELEVANT INDICATION ALLOWED	NDT CERTIFICATE	3/2.	2,1		WITNESS BY BHEL & VERIFICATION BY CUSTOMER
2.6	CASINGS/ BOWLS, STAGE BODIES, DISCHARGE HEAD (IF CAST), SUCTION HOUSING, COLUMN PIPE DISCHARGE PIPE ETC	LEAK TIGHTNESS	CR	VISUAL	100%	TECHNICAL DATA SHEET AND NOTE 2	NO LEAKAGE FOR TEST DURATION OF 30 MIN.	HT CERTIFICATE	3/2.	2,1		HAMMERING OF CASTINGS WITH WOODEN/ RUBBER MALLET BEFORE HYDRO TEST
BHEL				PARTICULARS		BIDDER / VENDOR						
				NAME								
				SIGNATURE								
				DATE					BIDDER/VENDOR SEAL			

NAME SIGN. DATE	Prepared By AJAY JAIN 23-07-2012	Reviewed By ASHWANI KHANNA 23-07-2012
	Approved By I. J. SINGH 23-07-2012	



BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN

Rev-01

QUALITY PLAN FOR MISCELLANEOUS PUMPS				CUSTOMER		PROJECT TITLE						
				BIDDER/VENDOR		QUALITY PLAN NUMBER						
SHEET 3 OF 6				SYSTEM		ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL)						
S. No.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.7	FABRICATED COMPONENTS											WELDING PROCEDURE APPROVAL BY BHEL ALT. 3RD PARTY (LLYODS, BVQI OR EQ.) IS ACCEPTABLE.
2.7.1	WELDING PROCEDURE SPECIFICATION	CORRECTNESS	MA	EXAM.	100%	ASME SEC.IX	ASME SEC.IX	QW 482 OF ASME SEC.IX	3/2.		2,1	
2.7.2	WELDING PROCEDURE QUALIFICATION	WELD SOUNDNESS	MA	VISUAL,PHYS. TESTS RT (AS APPLICABLE)	100%	ASME SEC.IX	ASME SEC.IX	QW 483 OF ASME SEC.IX	3/2.		2,1	
2.7.3	WELDER PERFORMANCE QUALIFICATION	WELD SOUNDNESS	MA	VISUAL,PHYS. TESTS RT (AS APPLICABLE)	100%	ASME SEC.IX	ASME SEC.IX	QW 484 OF ASME SEC.IX	3/2.		2,1	
2.7.4	WELD FIT-UPS	DIMENSION & ALIGNMENT	MA	MEAS.VISUAL EXAM	100%	WPS, MFG . DRAWING	WPS, MFG . DRAWING	IR/LOGBOOK	3/2.			
2.7.5	ROOT RUNS	SURFACE DEFECTS	MA	PENETRANT TEST	100%	ASTM E 165	NO SURFACE DEFECT	DO.	3/2.		2, 1	
2.7.6	WELDMENTS	SURFACE DEFECTS	MA	PENETRANT TEST	100%	ASTM E 165	ASME-VIII,DIV I	INSPN REPORT	3/2.		2,1	
BHEL				PARTICULARS		BIDDER / VENDOR						
				NAME								
				SIGNATURE								
				DATE								
BIDDER/VENDOR SEAL												

NAME	Prepared By AJAY JAIN <i>Ajay</i>	Reviewed By ASHWANI KHANNA <i>Ashwani</i>	Approved By I. J. SINGH <i>I. J. Singh</i>
SIGN.			
DATE	23-07-2012	23-07-2012	23-07-2012



BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN

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QUALITY PLAN FOR MISCELLANEOUS PUMPS				CUSTOMER		PROJECT TITLE						
				BIDDER/VENDOR		QUALITY PLAN NUMBER						
SHEET 4 OF 6				SYSTEM		ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL)						
S. No.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.7.7	BUTT WELDS	INTERNAL DEFECT	MA	UT/RT	100%			IR	3/2.		2.1	
2.7.8	DICHARGE HEAD, COLUMN PIPE, DISCHARGE PIPE, ETC.	1. LEAK TIGHTNESS 2. DIMENSION	CR	1. HYDROTEST 2. MEASUREMENT	100%	TECHNICAL SPEC/ DATA SHEET, MFR DRAWING	1. NO LEAKAGE 2. MFR. DRAWING	IR	3/2.	2.1		
3.0	SUB-ASSEMBLY CONTROL											
3.1	ROTOR ASSEMBLY	ECCENTRICITY	MA	MEASUREMENT	100%	MFR.DRAWING	MFR.DRAWING	IR/LOG BOOK	3/2.		1	
3.2	ROTOR ASSEMBLY RESIDUAL UNBALANCE	STATIC & DYNAMIC	CR	STATIC & DYNAMIC BALANCING	100%	ISO 1940	ISO1940 Gr 6.3	BALANCING CERTIFICATE	3/2.	2.1		WTNESSING ONLY FOR SIZE GREATER THAN 10KW
3.3	COMPLETE PUMP ASSEMBLY	COMPLETENESS, CORRECTNESS, CLEANLINESS, CLEARANCES, FREENESS, ALIGNMENT	MA	VISUAL EXAM MEASUREMENT	100%	APPROVED DRG & MFG STANDARDS	APPROVED DRG & MFG STANDARDS	I.R. & CHECK LISTS	3/2.		2.1	
BHEL				PARTICULARS		BIDDER / VENDOR						
				NAME								
				SIGNATURE								
				DATE					BIDDER/VENDOR SEAL			

NAME	Prepared By AJAY JAIN	Reviewed By ASHWANI KHANNA	Approved By I. J. SINGH
SIGN.			
DATE	23-07-2012	23-07-2012	23-07-2012



BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN

Rev-01

QUALITY PLAN FOR MISCELLANEOUS PUMPS				CUSTOMER		PROJECT TITLE						
				BIDDER/VENDOR		QUALITY PLAN NUMBER						
SHEET 5 OF 6				SYSTEM		ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL)						
S. No.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
4	FINAL INSPECTION, TESTS & PACKING DESPATCH CONTROL											
4.1	PUMP WITH JOB/SHOP MOTOR ASSEMBLED ON INDIVIDUAL BASE FRAME	1. Q V/S HEAD, 2. Q V/S POWER, 3. Q V/S PUMP EFF. 4. VIBRATION 5. NOISE 6. BEARING TEMP. 7. LEAKAGES	CR	PERFORMANCE TEST	100%	APPD. PERFORMANCE TEST PROCEDURE/ APPD. DATA SHEET/APPD. CURVES FOR VIBRATIONS - AS PER ANSI/HIS 9.6.4-2009 (VALUES AS PER APPROVED DATA SHEET) FOR BEARING TEMP - BEARING HOUSING SHOULD NOT BE UNTOUCHABLY HOT. FOR LEAKAGE - MINOR LEAKAGE (DROP BY DROP) IN CASE OF GLAND PACKING ARRANGEMENT.	I.R., PERF. TEST RECORD, PLOTTED CURVES	3/2.	2,1.			* MINIMUM 7 POINTS FROM SHUT-OFF TO MAX. OPERATING FLOW COVERING ENTIRE OPERATION RANGE OF PUMP SHALL BE TAKEN.
		NPSH/ MIN. SUBMERGENCE REQUIRED	CR	NPSH TEST	1/MODEL	DO.	IR. NPSH/MIN. SUBMERGENCE TEST RECORD, PLOTTED CURVES	3/2.	2,1.			IF SPECIFIED or INSISTED BY CUSTOMER.
4.2	STRIP DOWN AFTER PERFORMANCE TEST	1. UNDUE WEAR TEAR AND RUBBING	MA	VISUAL EXAM AFTER STRIPPING	1/MODEL	NO UNDUE WEAR TEAR & RUBBING ON IMPELLER & WEAR RING	INSP. REPORT	3/2.	1			WITNESS REQUIRED ONLY WHEN ABNORMAL SOUND OBSERVED DURING PERFORMING TEST.
4.3	COMPLETE PUMP WITH UNIT MOTOR BASE FRAME, COUNTER FLANGES ETC. INCLUDING ALL ACCESSORIES AS PER SECTION C OF SPECN.	COMPLETENESS, CLEANLINESS, OVERALL DIMENSIONS ORIENTATION, WORKMANSHIP AND FINISH	MA	VISUAL EXAM MEASUREMENT	100%	APPD. G.A DRAWING	APPD. G.A DRAWING	INSP. REPORT	3/2.	1		
BHEL				PARTICULARS		BIDDER / VENDOR						
				NAME								
				SIGNATURE								
				DATE					BIDDER/VENDOR SEAL			

NAME	Prepared By	Reviewed By
SIGN.	AJAY JAIN	ASHWANI KHANNA
DATE	23-07-2012	23-07-2012
		Approved By
		I. J. SINGH
		23-07-2012



BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN

Rev-01

QUALITY PLAN FOR MISCELLANEOUS PUMPS				CUSTOMER		PROJECT TITLE				
				BIDDER/VENDOR		QUALITY PLAN NUMBER				
SHEET 6 OF 6				SYSTEM		ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL)				

S. No.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
4.4	COMPLETION OF ALL STAGES	1.COMPLETION	MA	VERIFICATION OF IR/T.C.ETC.	100%	MFG. DRG./TECHNICAL DOCS.	APPD. MFG. DRG./TECHNICAL DOCS	IR.	3/2.	2,1		WITNESSING ONLY BY BHEL, CUSTOMER VERIFICATION ONLY BUT CHP
4.5	PAINING	1.SURFACE FINISH, DFT, MARKINGS ETC.	MA	VISUAL EXAM MEASUREMENT AESTHETIC	100%	APPD.DRG.	APPD.DOCS	IR.	3/2.		2	
4.6	PACKING, MARKING	SOUNDNESS OF PACKING	MI	VISUAL AESTHETIC	100%	MFG. STANDARD	MFG. STANDARD		3/2.		2	

MTC -Mill Test Certificate, MA-Major, MI-Minor, TC-Test Certificate, CR-Critical, IGC- Inter Granular Corrosion

- 1.AS CAST HEAT MARKS SHALL BE PROVIDED ON CI CASTING LIKE TOP & BOTTOM CASING.
2. HYDRO TEST PRESSURE SHALL BE AT LEAST 2(TWO) TIMES THE DUTY POINT (OR) 1.5 TIMES OF SHUT OFF HEAD (OR) SYSTEM DESIGN PRESSURE, WHICHEVER IS HIGHER.
3. THIS QAP IS ALSO APPLICABLE FOR SPARES.
4. NO WELD REPAIRS PERMISSIBLE ON CI CASTING.
5. MATERIAL SHALL BE AS PER APPROVED CROSS SECTION DRG./ DATA SHEET.
6. STRIP TEST- INCASE OF ABNORMAL NOISE OBSERVED DURING PERF. TEST, THOSE PUMP WILL BE STRIPPED DOWN FOR VISUAL INSPECTION OF IMPELLER & WEAR SHALL BE OFFERED FOR VISUAL INSPECTION FOR WEAR /RUBBING MARKS.
7. PUMPS WITH MECHANICAL SEAL ARRANGEMENT TO BE TESTED AND SUPPLIED WITH GLAND PACKING ARRANGEMENT. HOWEVER MANUFACTURER TO ENSURE DIMENTIONAL MATCHING OF MECHANICAL SEAL WITH PUMP GA DRAWING.

LEGEND : 1- BHEL OR BHEL NOMINATED THIRD PARTY /END CUSTOMER OF BHEL,
 2- VENDOR,
 3-SUB-VENDOR

P- PERFORM, W- WITNESS, V-VERIFICATION

BHEL	PARTICULARS	BIDDER / VENDOR
	NAME	
	SIGNATURE	
	DATE	

BIDDER/VENDOR SEAL

NAME SIGN. DATE	Prepared By AJAY JAIN 23-07-2012	Reviewed By ASHWANI KHANNA 23-07-2012	Approved By I. J. SINGH 23-07-2012
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TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-415-100-N011**

SECTION: **II**

SUB-SECTION: **IIB**

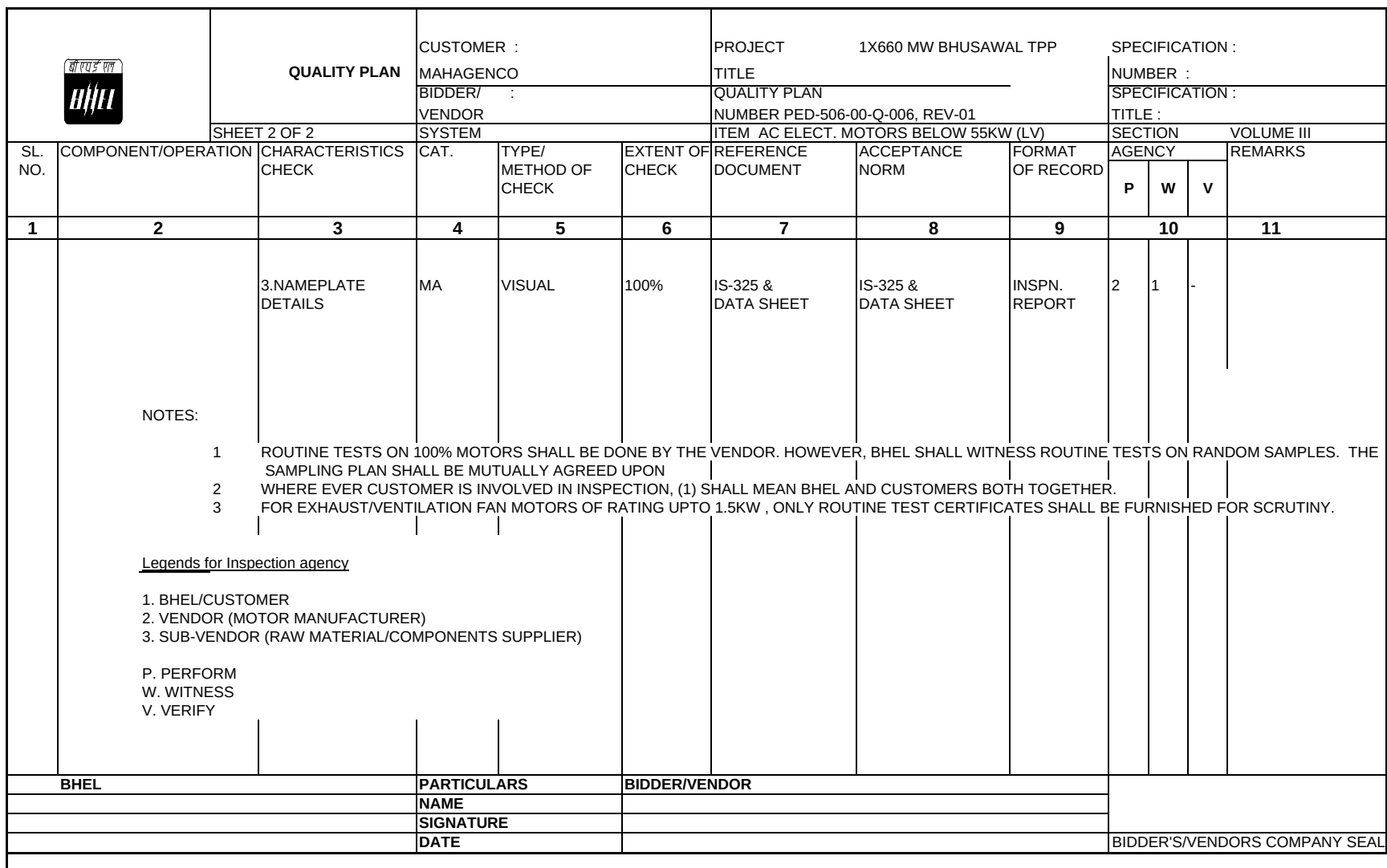
REV. NO. **00** DATE 10.12.2019

SHEET **1** OF **1**

SUB-SECTION - IIB

STANDARD TECHNICAL SPECIFICATION (ELECTRICAL)

		QUALITY PLAN SHEET 1 OF 2		CUSTOMER : MAHAGENCO		PROJECT 1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01		SPECIFICATION TITLE				
				SYSTEM		ITEM AC ELECT. MOTORS BELOW 55KW (LV)		SECTION VOLUME III				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1		NOTE -1 & NOTE-3
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	NOTE -1 & NOTE-3
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									



		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP TITLE		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE				
		SHEET 1 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION		VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	11	
1.0	RAW MATERIAL & BOUGHT OUT CONTROL											
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT	3	-	2	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVENT IS/SPEC.	SUPPLIERS TC & LOG	3	-	2	
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	2	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVENT IS/	SUPPLIER'S TC	3	-	2	
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUFR'S DRG.	MANUFR'S DRG.	LOG BOOK	3	-	2	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	2	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN SHEET 2 OF 9		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :					
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE					
				SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION		VOLUME III			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
1	2	3	4	5	6	7	8	9	P	W	V	11	
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED	
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2		
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	2		
		4.INTERNAL FLAWS	CR	UT	-DO-	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1		
1.6	SPACE HEATERS, CONNNECTORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. SPEC.	-DO-	3	-	2	FOR DIA OF 55 MM & ABOVE	
		2. PHYSICAL COND.	MA	-DO-	-DO-	-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	-DO-	3	-	2		
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	2		
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	2		
BHEL			PARTICULARS		BIDDER/VENDOR								
			NAME										
			SIGNATURE										
			DATE					BIDDER'S/VENDORS COMPANY SEAL					

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT 1X660 MW BHUSAWAL TPP TITLE		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE				
		SHEET 3 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION		VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC.	MA	VISUAL	100%	-	NO VISUAL DEFECTS	INSPT. REPORT	3	-	2	FOR MV MOTOR INSULATION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT * MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER.
		2. OTHER CHARACTERISTICS	MA	TEST	SAMPLE	MANUF'S SPEC.	MANUF'S SPEC.	LOG BOOK AND OR SUPPLIER'S TC	3	-	2	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND.	MA	VISUAL	100%	-	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK	3	-	-	
		2.DIMENSIONS INCLUDING BURS HEIGHT	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG. .	MANUFR'S DRG.	-DO-	3	-	2	
		3. ACCEPTANCE TESTS	MA	ELECT. & MECH TESTS	-DO-	MANUF'S SPEC./ RELEVANT IS	RELEVANT IS	SUPPLIER'S TC	3	-	2	
1.9	CONDUCTORS	1. SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	LOG BOOK	3*	-	2*	
		2.ELECT. PROP, & MECH. PROP	MA	ELECT. & MECH.TEST	SAMPLES	RELEVANT IS/ BS OR OTHER STANDARDS	RELEVANT IS/ BS OR OTHER STANDARDS	SUPPLIERS TC & VENDOR'S INSPN. REPORTS	3	-	2	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT 1X660 MW BHUSAWAL TPP TITLE		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE				
		SHEET 4 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION		VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.10	BEARINGS	3.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	-DO-	Log Book	3	-	2	
		1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG./ APPROVED DATASHEET	MANFR'S DRG./ APPROVED DATASHEET	-DO-	3	-	2	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	3	-	2	
		3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	2	
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-DO-	-DO-	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	-DO-	MANUF'S SPEC./ BHEL SPEC.	MANUF'S SPEC./ BHEL SPEC.	-DO-	3	-	2	
		4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	2	
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	MANUF'S DRG/SPECS	MANUF'S DRG./ SPECS.	-DO-	3	-	-	
		2.SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT 1X660 MW BHUSAWAL TPP TITLE			SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE				
		SHEET 5 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
									P	W	V		
1	2	3	4	5	6	7	8	9	10			11	
2.0	IN PROCESS												
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3/2	2	-		
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-		
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	2	-	-		
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-		
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVANT SPEC./ ASTM-E165	MANUF'S SPEC./ BHEL SPEC./	-DO-	2	-	1		
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANFR'S SPEC/BHEL SPEC./ RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-		
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	2	-	-		
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-		
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	2	-	-		
BHEL			PARTICULARS		BIDDER/VENDOR								
			NAME										
			SIGNATURE										
			DATE										
												BIDDER'S/VENDORS COMPANY SEAL	

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT 1X660 MW BHUSAWAL TPP TITLE		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE				
		SHEET 6 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION		VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUFR'S SPEC.	MANUFR'S SPEC.	Log Book	2	-	-	(FOR MOTORS OF 2MW AND ABOVE) * ON 10% RANDOM SAMPLE
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	2	-	-	
		3.CORE LOSS & HOTSPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	2	1*	1	
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	2	-	-	
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		6.SURGE WITH STAND AND TAN. DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
2.6	IMPREGNATION	1.VISCOSCITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-	-	FOR MV MOTOR
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	2	-	-	
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP TITLE		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE				
		SHEET 7 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION		VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	VERIFICATION FOR MV MOTOR ONLY
2.8	BRAZING/COMPRESSION JOINT	1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-DO-	-DO-	Log Book	2	-	-	
2.9	COMPLETE ROTOR ASSEMBLY	1.COMPLETENESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.SOUNDNESS	CR	MALLET TEST & UT	-DO-	-DO-	-DO-	Log Book	2	-	1	
		3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	-	1	
2.10	ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	2	-	1	
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	2	-	1	
		1.ALIGNMENT	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.WORKMANSHIP	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.AXIAL PLAY	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.DIMENSIONS	MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IS	Log Book	2	-	-	
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2	-	-	
		6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2	-	1	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE		BIDDER'S/VENDORS COMPANY SEAL							

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT 1X660 MW BHUSAWAL TPP TITLE			SPECIFICATION : NUMBER :			
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
		SHEET 8 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC CLAUSE 8.1.2	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1	1	\$ NOTE - 2 \$ NOTE - 2 \$ NOTE - 2 \$ REFER NOTE-3 \$ NOTE - 2 \$ NOTE - 2 \$ NOTE - 2 TC FROM AN INDEPENDENT LABORATORY ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR. SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY \$ NOTE - 2
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^{\$}	1	
		3.VIBRATION & NOISE LEVEL	MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	2	1 ^{\$}	1	
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	2	1*	1	
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^{\$}	1	
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^{\$}	1	
		8. NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1 ^{\$}	1	
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	2	-	1	
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1 ^{\$}	1	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
									BIDDER'S/VENDORS COMPANY SEAL			



		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP TITLE		SPECIFICATION : NUMBER :			
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE			
		SHEET 9 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P W V		REMARKS
1	2	3	4	5	6	7	8	9	10	11	
NOTES: 1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED. 2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON. 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED FOR FIRST NUMERAL OF IP-XX. SECOND NUMERAL TEST SHALL BE CARRIED OUT ON ONE MOTOR OF EACH TYPE & RATING. 4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. <u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY											
BHEL			PARTICULARS		BIDDER/VENDOR			BIDDER'S/VENDORS COMPANY SEAL			
			NAME								
			SIGNATURE								
			DATE								



TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-415-100-N011**

SECTION: **III**

SUB-SECTION:

REV. NO. **00** DATE 10.12.2019

SHEET **1** OF **1**

SECTION III

DOCUMENTS TO BE SUBMITTED BY BIDDER



TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-415-100-N011**

SECTION: **IIIA**

SUB-SECTION:

REV. NO. **00** DATE 10.12.2019

SHEET **1** OF **1**

SECTION IIIA

**GUARANTEE SCHEDULE
(TO BE SUBMITTED ALONG WITH THE BID BY ALL BIDDERS)**



SCHEDULE OF PERFORMANCE GUARANTEES
1X660 BHUSAWAL TPS

SPECN. NO.:	PE-TS-415-100-N011, Rev-00			
VOLUME:	--	SECTION:	IIIA Sheet 1 of 1	
REV. NO.	00	DATE:	01.01.2020	

Following parameters are guaranteed for following pumps

Sl. No.	Pump Description	Guaranteed Capacity	Guaranteed TDH	Guaranteed Pump Eff.	Guaranteed Motor Eff.	Guaranteed Power consumption at inlet to motor terminals	Pump model	Motor Rating	Pump GD ² Value for HT motor only	Pump RPM	T/S Curve attached for HT motor
		(M3/Hr)	(MWC)	%	%	(KW)		(KW)			
	Vertical Pumps										
1	POTABLE WATER PUMPS (PLANT)	20	57								
2	POTABLE WATER PUMPS (COLONY)	25	53								
3	APH/ESP WASH PUMPS	420	86								
4	SERVICE WATER PUMPS	150	65								
5	SCR PUMPS	60	68								
6	#CT MAKEUP PUMPS	850	12								
7	#AHP PUMPS	120	62								
8	#FGD PUMPS	200	55								
9	#INTAKE WATER BOOSTER PUMPS	1500	28								
10	#ASH WATER PUMPS	900	35								
11	#RAW WATER PUMPS	1160	20								
12	#ACW PUMPS	3910	46		95						YES

Note: 1 # Bid evaluation and LD is applicable for these pumps only as per clause 4.00.00 of Section-IIA & Data Sheet-A of Section-ID of Technical Specification for pumps.

We the undersigned hereby undertake to meet the performance guarantees as listed in the table above on the conditions as elsewhere specified. Any variation of the specified conditions during official tests will be taken in account by the customer

PARTICULARS OF BIDDER/ AUTHORISED REPRESENTATIVE

NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL
------	-------------	-----------	------	--------------



TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-415-100-N011**

SECTION: **IIIB**

SUB-SECTION:

REV. NO. **00** DATE 10.12.2019

SHEET **1** OF **1**

SECTION IIIB

**COMPLIANCE CERTIFICATE
(TO BE SUBMITTED ALONG WITH THE BID BY ALL BIDDERS)**

	TECHNICAL SPECIFICATIONS	SPECN. NO.:	PE-TS-415-100-N011, Rev.0		
	MISCELLANEOUS PUMPS	VOLUME:	--	SECTION:	IIIB
	COMPLIANCE CERTIFICATE	REV. NO.	0	DATE:	10.12.2019
The bidder shall confirm compliance with following by signing/ stamping this compliance certificate and furnish same with the offer. a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions/ deviations with regard to same. b) QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ CONSULTANT/ CUSTOMER approval in the event of order & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. c) All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/ CONSULTANT/ CUSTOMER approval. d) There are no other deviation with respect to specification other than those furnished in the 'Schedule of Deviations'. e) Bidder shall include the cost of Mandatory Spares, unless specified otherwise in Sec-IA of the specification or NIT. Any mandatory spares stated as not applicable, shall have to be supplied without any cost implication to BHEL in the event they are found to be applicable during detail engineering stage. f) The offered materials should be either equivalent or superior to those specified. Also for components where material is not specified it shall be suitable for intended duty. All materials shall be subject to approval in the event of order. g) Prices for recommended spares (if any) for 3 years operation shall be furnished separately & not included in the base price. h) The commissioning spares (if any) are supplied on 'As Required Basis' & prices for same included in the base price (If bidders reply to this is "No commissioning spares are required" and if some spares are actually required during commissioning same shall be supplied by bidder without any cost to BHEL). i) All sub vendors shall be as per BHEL/CONSULTANT/CUSTOMER approved list. j) Tests for noise, vibration, parallel running etc. for pumps shall be conducted at site by Pump Vendor/BHEL as per cl. no. 3.04.00 of Section-IIA and if the site performance is found not meeting the requirements in any respect as specified, than the equipment shall be rectified or replaced by the vendor, at his own cost. k) Any special tools & tackles, if required, shall be in bidder's scope. l) All models offered have been supplied by bidder in the past and are meeting the experience qualifying criteria of BHEL/CONSULTANT/CUSTOMER (viz. offered model is successfully operating in two separate stations for at least one year or as specified in technical PQR). Any deviation to this criteria shall be suitably highlighted in deviation schedule. m) All selected motor ratings have minimum margins as per Datasheet A, Section ID.					
We the undersigned hereby undertake to meet the compliance requirements as listed above on the conditions as elsewhere specified.					
PARTICULARS OF BIDDER/ AUTHORISED REPRESENTATIVE					
NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL	



TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-426 -100-N001**

SECTION: **IIIC**

SUB-SECTION:

REV. NO. **00** DATE 19.10.2019

SHEET **1** OF **1**

SECTION IIIC

**DEVIATION SCHEDULE – AS PER NIT FORMAT
(TO BE SUBMITTED ALONG WITH THE BID BY ALL BIDDERS)**



TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-415-100-N011**

SECTION: **IIID**

SUB-SECTION:

REV. NO. **00** DATE 10.12.2019

SHEET **1** OF **1**

SECTION IIID

DATA SHEET – B FOR PUMPS

**(TO BE SUBMITTED BY SUCCESSFUL BIDDER AFTER AWARD OF
CONTRACT)**

		PROJECT: MISCELLANEOUS PUMPS DATASHEET - B	
SL.	DESCRIPTION	UOM	PUMP DATA
1.0	GENERAL		
1.1	Designation of the Pump		
1.2	Manufacturer		
1.3	Model No.		
1.4	No. of pumps	Nos.	
1.5	System Design Pressure	Kg/cm ²	
1.6	Specific Gravity of fluid to be handled	-	
2.0	PERFORMANCE PARAMETERS		
2.1	Performance standard		
2.2	Rated capacity. (No negative tolerance)	M ³ /hr	
2.3	Total Dynamic Head (TDH) at rated capacity (No negative tolerance)	MWC	
2.4	Shut off head	MWC	
2.5	Range of Operation of the Pump		
	a) Min.Flow	M ³ /hr	
	b) Max.Flow	M ³ /hr	
2.6	The pumps offered have continuously rising head capacity curves from the duty point towards shut off point.		
2.7	The pumps offered have stable rising H-Q curves within the "Range of Operation"		
2.8	Pump rated speed	RPM	
2.9	Vibration measurements (2.9.2 is applicable in addition to 2.9.1 for Pumps with speed less than 600 RPM)		
2.9.1	Max.value of vibration on any pump /motor bearing w.r.t. velocity (Vrms) as per ANSI/ HIS 9.6.4 for speed > 600 RPM		
	a) Guaranteed at manufacturer's works	mm/s	
	b) Guaranteed at site	mm/s	
2.9.2	Max.value of vibration on any pump /motor bearing w.r.t. peak to peak amplitude as per ANSI/ HIS 9.6.4 for speed <= 600 RPM		
	a) Guaranteed at manufacturer's works	microns	
	b) Guaranteed at site	microns	
2.10	Max. noise Level (Guaranteed at site)	dB	
2.11	Guaranteed Pump efficiency at rated head & rated capacity without -ve tolerance	%	
2.12	Power consumption		
	a) Guaranteed pump input power at duty point	KW	
	b) Guaranteed max. Pump input power within range of operation.	KW	
	c) Max. pump input power at shut off	KW	
	d) Guranteed power at motor input	KW	
2.13	NPSH required at rated capacity	MWC	
3.0	DESIGN & CONSTRUCTION FEATURES		
3.1	Type of pump casing		
3.2	Pump duty		
3.3	Type of Impeller		
3.4	Location		
3.5	Pump suitable for parallel operation		
3.6	Torque speed curve of the pump & drive motor furnished for pumps with drive motor rating of 100 KW and above.		
3.7	Pump number of stages		

		PROJECT: MISCELLANEOUS PUMPS DATASHEET - B	
SL.	DESCRIPTION	UOM	PUMP DATA
3.8	Specific speed $N = \frac{\text{RPM} \times (\text{Flow in USGPM})^{1/2}}{(\text{Head in Ft.})^{3/4}}$		
3.9	Minimum suction head required in MLC for pump operation at maximum discharge point within the 'Range of Operation' specified (NPSHR at max. flow).		
3.10	Whether pump is suitable/designed so that pump internals can be attended without disturbing suction and discharge piping.		
3.11	Type of coupling between pump & motor		
3.12	Bearing (DE & NDE)		
	a) Type and manufacturer		
	b) Bearing no.		
	c) Type of lubrication		
	d) Design life (Hrs.)		
3.13	Shaft Sealing arrangement		
	a) Type and manufacturer		
	b) Sealing liquid		
	c) Requirement of external water if any		
	i) Quality		
	ii) Quantity/ Pump	M ³ /hr	
3.14	In case separate oil/grease/water pump or any such equipment required for bearing lubrication/stuffing box gland sealing, furnish full technical details of these equipment and their drive.		
4.0	MATERIAL OF CONSTRUCTION (Indicate applicable code/ standard)		
4.1	Casing		
4.2	Impeller		
4.3	Shaft		
4.4	Shaft sleeves		
4.5	Wear ring		
4.6	fasteners		
4.7	Gland		
4.8	Lantern ring		
4.9	Mechanical seals (faces)/		
	Gland packing		
4.10	Base plate		
5.0	CONNECTIONS AND OTHER DIMENSIONAL DETAILS		
5.1	Impeller diameter	mm	
6.0	DRIVE DATA		
6.1	Drive unit output at 50°C ambient condition	KW/ P	
7.0	INSPECTION & TESTING		
7.1	Material test		
7.2	Hydrostatic test pressure	Kg/cm ²	
7.3	Hydrostatic test duration	Min.	
7.4	Performance test on pump at shop		
7.5	Dyanamic balance test		
8.0	WEIGHT AND LOADING DATA		
8.1	Weight of the pump & drive assembly	Kg	
8.2	Weight of the heaviest piece to be handled	Kg	

		PROJECT: MISCELLANEOUS PUMPS DATASHEET - B		
SL.	DESCRIPTION	UOM	PUMP DATA	
8.3	Size of base plate (length x width)	mm		
9.0	ADDITIONAL INFORMATION FOR VERTICAL PUMPS			
9.1	Type of pump			
9.2	No. of stages for Vertical Turbine Pump	Nos.		
9.3	Bowl Head	MLC		
9.4	Bowl Efficiency	%		
9.5	Setting Length	m		
9.6	Column pipe OD X Thickness	mm X mm		
9.7	No of column pieces	Nos.		
9.8	No of intermediate shafts	Nos.		
9.9	No of bearings	Nos.		
9.10	Type & make of Bearing			
9.11	Sealing/lubrication arrangement of bearings			
9.12	Capacity of overhead forced lubrication tank	m ³		
9.13	Nos of forced lubrication pumps	Nos.		
9.14	Capacity of forced lubrication pumps	m ³ /Hr		
9.15	TDH of forced lubrication pumps	MLC		

	TITLE LV MOTOR DATA SHEET - C	SPECIFICATION NO.
		VOLUME II B
		SECTION D
		REV NO. 00 DATE
		SHEET 1 OF 2

S. No.	Description		Data to be filled by successful bidder
A.	General		
1	Manufacturer & country of origin		
2	Motor type		
3	Type of starting		
4	Name of the equipment driven by motor & Quantity		
5	Maximum Power requirement of driven equipment		
6	Rated speed of Driven Equipment		
7	Design ambient temperature		
B.	Design and Performance Data		
1	Frame size & type designation		
2	Type of duty		
3	Rated Voltage		
4	Permissible variation for		
5	a	Voltage	
6	b	Frequency	
7	c)	Combined voltage & frequency	
8	Rated output at design ambient temp (by resistance method)		
9	Synchronous speed & Rated slip		
10	Minimum permissible starting voltage		
11	Starting time in sec with mechanism coupled		
12	a) At rated voltage		
13	b) At min starting voltage		
14	Locked rotor current as percentage of FLC (including IS tolerance)		
15	Torque		
	a) Starting		
	b) Maximum		
16	Permissible temp rise at rated output over ambient temp & method		
17	Noise level at 1.0 m (dB		
18	Amplitude of vibration		
19	Efficiency & P.F. at rated voltage & frequency		
	a) At 100% load		
	c) At 75% load		

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE LV MOTOR DATA SHEET - C	SPECIFICATION NO.
		VOLUME II B
		SECTION D
		REV NO. 00 DATE
		SHEET 2 OF 2

S. No.	Description	Data to be filled by successful bidder
	c) At starting	
C.	Constructional Features	
1	Method of connection of motor driven equipment	
2	Applicable Standard	
3	DOP of Enclosure	
4	Method of cooling	
5	Class of insulation	
6	Main terminal box	
	a) Type	
	b) Power Cable details (Conductor, size, armour/unarmour)	
	c) Cable Gland & lugs details (Size, type & material)	
	d) Permissible Fault level (kArms & duration in sec)	
7	Space heater details (Voltage & watts)	
8	Flame proof motor details (if applicable)	
	a) Enclosure	
	b) suitability for hazardous area	
	i Zone	O / I / II
	ii Group	IIA / IIB / IIC
9	No. of Stator winding	
10	Winding connection	
11	Kind of rotor winding	
12	Kind of bearings	
13	Direction of rotation when viewed from NDE	
14	Paint Shade & type	
15	Net weight of motor	
16	Outline mounting drawing No (To be enclosed as annexure)	
D.	Characteristic curves/ drawings (To be enclosed for motors of rating $\geq 55\text{KW}$)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			