

RAICHUR POWER CORPORATION LIMITED (RPCL)

YERAMARAS STPS, 2 X 800 MW


VOLUME -IIB


**TECHNICAL SPECIFICATION
FOR
SPECIAL PROCESS VERTICAL PUMP**

Specification No. : PE-TS-362 -165-N001 (REV. 0)



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

	PREAMBLE	SPECN. NO.:	PE-TS-362 -165-N001		
		REV. NO.	0	DATE:	05.02.13
1.0	The tender document contains three (3) volumes. The bidder shall meet the requirements of all the three volumes.				
1.1	<p>Volume I - CONDITIONS OF CONTRACT</p> <p>This consists of four parts as below:</p> <p>Volume - I A : This part contains instructions to bidders for making bids to BHEL.</p> <p>Volume - I B : This part contains general commercial conditions of the tender and include provision that vendor shall be responsible for the quality of item supplied by their sub-vendors.</p> <p>Volume - I C : This part contains special conditions of contract.</p> <p>Volume - I D : This part contains commercial conditions for erection and commissioning site work, as applicable.</p>				
1.2	<p>Volume II - TECHNICAL SPECIFICATIONS</p> <p>Technical requirements are stipulated in Volume II which comprises of:</p> <p>Volume - II A : General Technical Conditions</p> <p>Volume - II B : Technical specification including drawings, if any</p>				
1.2.1	<p>Volume - II B :</p> <p>This volume is sub-divided into following sections:</p> <p>Section - A : This section outlines the scope of enquiry.</p> <p>Section - B : This section provides "Project Information"</p> <p>Section - C : This section indicates technical requirements specific to the contract, not covered in Section-D.</p> <p>Section - D : This section comprises of technical specifications of equipments complete with data sheet A, B & C.</p> <p>Data sheet - A specifies data and other requirements pertaining to the equipment.</p> <p>Data sheet - B specifies data to be filled by the bidder (Data Sheet B is contained in Volume - III)</p> <p>Data sheet - C indicates data documents to be furnished after the award of contract as per agreed schedule by the vendor (as applicable).</p>				
1.2.2	<p>Volume - III TECHNICAL SCHEDULES</p> <p>This volume contains technical schedules and Data Sheets - B, which are to be duly filled by the bidder and the same shall be furnished with the technical bid as per checklist, Section B-4 in Volume-III.</p>				
2.0	The requirements mentioned in Section C/Data Sheets-A of Section-D shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section - D.				

	TECHNICAL SPECIFICATIONS SPECIAL PROCESS VERTICAL PUMP	SPECN. NO.:		PE-TS-362 -165-N001	
		REV. NO.	0	DATE:	05.02.13
INDEX					
SECTION	TITLE				
A	SCOPE OF ENQUIRY				
B	PROJECT INFORMATIONS				
B1	YERMARAS STPS, 2 X 800 MW				
C	SPECIFIC TECHNICAL REQUIREMENTS FOR				
C1	PUMPS				
D	STANDARD TECHNICAL SPECIFICATIONS FOR				
D1	PUMPS				
	<div><div>▪ STANDARD TECHNICAL SPECIFICATIONS FOR VERTICAL PUMPS- NO. PE-TS-179-07</div><div>▪ DATA SHEETS-A FOR ALL PROJECTS ALONGWITH RESPECTIVE LIST OF MANDATORY SPARES (IF APPLICABLE) & WATER ANALYSIS.</div><div>▪ DATA SHEET - C</div><div>▪ STANDARD QUALITY PLAN FOR PUMPS</div></div>				



TECHNICAL SPECIFICATIONS
SPECIAL PROCESS VERTICAL
PUMP

SPECN. NO.: PE-TS-362 -165-N001

VOLUME:

IIB

SECTION:

A

REV. NO.


0

DATE:

05.02.13

SECTION A

SCOPE OF INQUIRY

	TECHNICAL SPECIFICATIONS SPECIAL PROCESS VERTICAL PUMP	SPECN. NO.: PE-TS-362 -165-N001			
		VOLUME:	IIB	SECTION:	A
	SCOPE OF ENQUIRY	REV. NO.	0	DATE:	05.02.13
<p>1.0 SCOPE</p> <p>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 check at site for Pumps, as detailed in clause 1.3 below, along with erection & commissioning spares, mandatory spares complete with all accessories as per the requirements specified in this specification & extended guarantee specified in NIT.</p> <p>The bidder's scope shall also include any other services, etc. if called for in the succeeding sections of the specification.</p> <p>1.2 The pumps covered under this specification shall be Vertical canister type pumps.</p> <p>1.3 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. The charges for same shall be included by bidder in his base price, itself.</p> <p>1.4 The pumps covered under this specification for various projects is as per annexure I. HT drives shall be issued free of cost by BHEL.</p> <p>The Capacity, Head, Materials of construction, Mandatory spares and other particulars of these pumps, are detailed in Data Sheet-A annexed with Section-D of the specification.</p> <p>1.5 For detailed scope of supply & services refer clause 3.00.00 of Standard technical Specification for Vertical pumps specified under Section-D of this volume, as reference. Further bidders to consider applicable requirements indicated in section D, for Pumps specified in this specification. Suction strainers (loose supply) are also included in scope of supply as per Datasheet A, Section D of this volume.</p> <p>2.0 GENERAL TECHNICAL INSTRUCTIONS</p> <p>2.1 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.</p> <p>2.2 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.</p> <p>2.3 BHEL's / Customer's representative shall be given full access to the shop in which the equipments are being manufactured or tested and all test records shall be made available to him.</p> <p>2.4 The equipments covered under this specification shall not be despatched unless the same have been finally inspected, accepted and shipping release issued by BHEL/Customer.</p> <p>2.5 <i>In case of any deviation from this technical specification (Vol.IIB) and General Technical Conditions (Vol.II A), the same shall be indicated in the schedule of deviations enclosed in Vol.III. In the absence of duly filled schedules it will be assumed that the bid strictly conforms to the specification.</i></p> <p>2.6 Unpriced copy of the price bid shall be furnished alongwith the technical bid.</p>					

	TECHNICAL SPECIFICATIONS SPECIAL PROCESS VERTICAL PUMP		SPECN. NO.:		PE-TS-362 -165-N001		
			VOLUME:		IIB	SECTION: A	
			REV. NO.		0	DATE: 05.02.13	
Annexure I							
List of Miscellaneous Pumps and drives for various projects:							
1.0 YERMARAS STPS, 2 X 800 MW							
Sl. No.	Pump Description				Total Qty.	Type of Pumps	
1	DRIP PUMPS				4 nos.	VERTICAL CANISTER TYPE	



TECHNICAL SPECIFICATIONS
SPECIAL PROCESS VERTICAL
PUMP


SPECN. NO.: PE-TS-362 -165-N001


VOLUME:	IIB	SECTION:	B
REV. NO.	0	DATE:	05.02.13


SECTION B


PROJECT INFORMATION

YERAMARAS STPS, 2 X 800 MW

RPCL/YTPS		RAICHUR POWER CORPORATION LIMITED		SECTION: B	
		YERAMARUS TPS - 2x800 MW		VOLUME-II	
		PROJECT INFORMATION		Page 1 of 3	
TITLE					
1.0	Owner	:	Raichur Power Corporation Ltd 22/23, Sudarshan Complex, IInd floor, Sheshadri Road, Bangalore-560 009 Karnataka, India		
2.0	Consultant	:	M/s Evonik Energy Services (I) Private Limited,A-29, Sector 16 Noida-201301(UP), India		
3.0	Project Title	:	2x800 MW Yeramarus Thermal Power Station		
4.0	Location	:	Yermarus , Raichur Dist Karnataka State, INDIA It is situated at about 8 Kms from Raichur on the Raichur-Hyderabad State Highway-13 and 12 kms away from Bank of river Krishna and about 5 kms from Raichur Thermal Power Station		
5.0	Nearest Railway	:	Chicksugur Railway Station which is about 2 kms from site.		
6.0	Nearest Airport	:	Hyderabad around 200 kms		
7.0	Nearest Port	:	Chennai around at about 470 kms from site.		
8.0	Latitude and Longitude	:	Latitude - 16° 16' 55.9"N Longitude - 77° 20' 38.6"E		
9.0	Elevation above mean sea level	:	350-375 meters		
10.0	<u>Climatic Conditions</u>				
	(a) <u>Ambient Temperature</u>				
	i.	maximum temperature	:	45° C	
	ii	minimum temperature	:	6° C	
	ii	Design Temperature	:	50° C Ambient	
	i.	for all Elec/ Mech Equipment	:		
	(b) Relative Humidity				
	i.	Maximum during monsoon	:	85%	
	ii.	Minimum	:	20%	
	iii.	Average	:	65%	

RPCL/YTPS 	RAICHUR POWER CORPORATION LIMITED YERAMARUS TPS - 2x800 MW PROJECT INFORMATION	SECTION: B VOLUME-II Page 2 of 3
	<p>(c) <u>Rainfall</u></p> <p>Annual average rain : 720 mm</p> <p>Max. for one day : 115 mm</p> <p>Max. intensity : 38 mm/hr</p> <p>Period : June to September</p> <p>(d) <u>Wind Speed</u></p> <p>i. Prevailing wind direction : West, South-East, North-West, South-West</p> <p>ii. Maximum mean wind speed : 15.9 Kms / hr (4.42 m/s)</p> <p>iii. Average : 9.61 Km/hr (2.67 m/s)</p> <p>11.0 Wind Load</p> <p>Calculations for wind effect shall be in accordance with IS:875- (Part-3) latest revision taking into account the following :</p> <p>(a) Basic wind speed of 39 m/sec as given in Fig.1 of the code.</p> <p>(b) Factor K1 shall be taken as 1.06</p> <p>(c) Terrain category shall be 2 and corresponding values shall be taken for K2</p> <p>(d) Factor K3 shall be taken as 1.0</p> <p>12.0 Wind Loading for Stack</p> <p>(a) For wind pressure as per clause 11.0 above</p> <p>(b) For RC stacks as per IS: 4998</p> <p>13.0 Seismic data (as per IS:1893 latest issue)</p> <p>(a) Zone : Zone III (as per IS:1893- latest)</p> <p>(b) Importance factor (I) : 1.75</p> <p>14.0 Auxiliary power supply : Auxiliary electrical equipment to be supplied against this specification shall be suitable for operation on the following supply system.</p> <p>(a) For motors rated above 1500 kW : 11000V, 3 phase, 3 wire, 50Hz medium earthed AC</p> <p>(b) For motors rated 175KW and above and below 1499KW. : 3300V, 3 phase, 3 wire, 50Hz medium earthed AC</p> <p>(c) For motor rated 174 kW and below : 415, 3 phase, 3 wire solidly earthed AC</p> <p>(d) For motor control centre : 415V, 3 phase, 3 wire solidly earthed AC</p> <p>(e) DC. motor starters, DC solenoids, DC alarm, control and protections : 220 V DC, 2 wire, unearthed DC</p>	

	RAICHUR POWER CORPORATION LIMITED YERAMARUS TPS - 2x800 MW PROJECT INFORMATION	SECTION: B VOLUME-II Page 3 of 3
	<p>(f) AC control & protective devices : 110 V 1 phase, 50Hz, 2 wire AC supply. The single-phase 110V AC supply shall be derived by Contractor by providing 415V/110V control transformers of adequate rating with MCCB /MCB on both the primary and secondary sides.</p> <p>(g) Uninterrupted power supply : 240 V, 1 phase, 50Hz, 2 wire AC supply from UPS system for I&C (including indicator recorders) and UCMS only</p> <p>(h) AC solenoids, indicators/recorders, space heaters (for motors rated 30KW and above) : 240V 1 phase, 2 wire, 50Hz AC system with effectively earthed neutral. The power supply shall be derived by CONTRACTOR by providing 415V/ 240V transformer of adequate rating with MCCB/MCB on primary/secondary sides.</p> <p>(i) Winding heating of motors below 30kW : 24 V 1 phase,50Hz, AC with one point earthed. This shall be derived by CONTRACTOR by providing 415V 3 phase, 3 wire, AC supply through an adequately rated step-down transformer of adequate rating with MCCB / MCB on primary/secondary sides.</p> <p>(j) Solid state controls (including solenoid valves) : 24 V DC, 2 wire, supply from Battery chargers for instrumentation system only.</p> <p>(k) Lighting fixtures : 240 V, 1 phase, 2 wire, 50Hz system.</p> <p>(l) Lighting fixtures and space heaters in panels : 240 V, 1 phase, 2 wire, 50Hz system.</p> <p>(m) Construction supply : 415 V, 3 phase, 4 wire, 50 Hz AC supply with neutral lead solidly earthed.</p> <p>(n) The above voltages may vary as follows : All devices shall be suitable for continuous operation over the entire range of voltage and frequency indicated below without any change in their performance.</p> <p>i. AC supply : Voltage variation $\pm 10\%$ Frequency variation $\pm 5\%$ Combined voltage & frequency variation $\pm 10\%$</p> <p>ii. DC supply : Voltage variation +10% - 20%</p>	

	TECHNICAL SPECIFICATIONS SPECIAL PROCESS VERTICAL PUMP	SPECN. NO.:		PE-TS-362 -165-N001	
		VOLUME:		IIB	SECTION: C
		REV. NO.		0	DATE: 05.02.13
<div>SECTION C</div> <div>SPECIFIC TECHNICAL REQUIREMENTS</div> <div>C1: SPECIFIC TECHNICAL REQUIREMENTS FOR PUMPS</div>					



TECHNICAL SPECIFICATIONS SPECIAL PROCESS VERTICAL PUMP

SPECN. NO.:	PE-TS-362 -165-N001
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VOLUME:

	IIB
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SECTION:

C1

REV. NO.


0


DATE:

05.02.13

SECTION C1

SPECIFIC TECHNICAL REQUIREMENTS FOR PUMPS

	TECHNICAL SPECIFICATIONS SPECIAL PROCESS VERTICAL PUMP	SPECN. NO.:	PE-TS-362 -165-N001		
		VOLUME:	IIB	SECTION:	C1
		REV. NO.	0	DATE:	05.02.13
SPECIFIC TECHNICAL REQUIREMENTS:					
<p>1.0 DELIVERY: Delivery of miscellaneous pumps from date of LOI, for various projects shall be as per NIT requirement.</p> <p>The delivery periods shall be as per NIT requirements, considering 8 weeks cumulative approval time taken by BHEL & Customer for the project. The cumulative approval time shall be the time for all the submitted revisions put together.</p> <p>The drawings to be submitted by bidder in the event of order for each project shall be :</p> <ul style="list-style-type: none"> • Pumps : <ul style="list-style-type: none"> ○ Technical Data Sheets and Performance Curves. ○ GA and Cross Sectional drawings ○ Quality Plan • Motors : <ul style="list-style-type: none"> ○ Technical Data Sheets, curves alongwith other motor documents ○ Motor GA drawing, terminal details, etc. ○ Quality Plan <p>Drawings submission schedule shall be as follows :</p> <p style="padding-left: 40px;">1st submission of drawings from date of LOI* shall be within 25 days.</p> <p>Every revised submission incorporating comments – Within 15 days.</p> <p>*For pumps where HT motor is to be free issue by BHEL, HT motor GA will only affect the GA drawing preparation from vender. Vendor to furnish tentative GA drawing for pump within specified time schedule. Vendor to furnish final GA drawing within 2 weeks of receipt of Motor GA drawing from BHEL. Bidders to note that HT motors inputs viz. Load Torque vs. speed curves of the pumps, selected motor ratings, rpm, GD2 value of driven equipment furnished along with offer shall be considered final and BHEL may proceed with final motor designs as per same.</p> <p>Drawings submitted shall be complete in all respects with revised drawing submitted incorporating all comments. Any incomplete drawing submitted shall be treated as non submission with delays to bidder's account. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL for across the table discussions/ finalisations/ submissions of drawings.</p>					
<p>2.0 Simplex basket type strainers shall be loose supply in scope of pump manufacturer as per details given in Data Sheet -A of Sec-D of this volume. Same to be fitted in suction/inlet piping of pump at site by BHEL Following shall include in strainer assembly:</p> <ol style="list-style-type: none"> a. Outer shell/housing with counter flanges, gaskets, nuts & bolts. b. Supporting lugs for supporting the strainers on floor - if applicable. c. Foundation bolts, nuts etc -if applicable d. Removable strainer element. e. Drain points with valves/plugs - as applicable. f. Final painting inline with the pump. 					
<p>3.0 In addition to documents listed in Clause 15.00.00 of Section D Standard Tech. Specification for Vertical Centrifugal Pumps, following Drawing/ Data are to be furnished with the offer/bid:</p> <ol style="list-style-type: none"> i) Pump GA and cross-sectional drawing, also indicating weight of the pump with base plate. For HT motor dimensions, bidder may assume a similar rating HT motors for furnishing (pump & motor) GA drawing alongwith bid. Bidder to note that GA drawing of pump with motor is required for layout planning by BHEL, which bidder may revise on the basis of actual GA, during detail engineering after LOI. ii) Technical Data Sheet - B attached in Vol. III of specification. iii) Anticipated pump performance curves. iv) Allowable forces and moment of the equipment. v) Complete descriptive and illustrative literature of pump and accessories offered. 					

	TECHNICAL SPECIFICATIONS SPECIAL PROCESS VERTICAL PUMP	SPECN. NO.:	PE-TS-362 -165-N001		
		VOLUME:	IIB	SECTION:	C1
		REV. NO.	0	DATE:	05.02.13

4.0 100% 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..

5.0 OTHER TECHNICAL REQUIREMENTS FOR DRIP PUMPS OF YERAMARAS PROJECT

5.1 Drip pumps for Yeramaras project are to be selected in such a manner that the selected pump shall cover all the four conditions (design condition & condition I, II & III) as indicated in datasheet A of section D of this volume without any change of pump internals.. For each flow requirement, the pump TDH (Total Dynamic Head) shall be equal to or more than the indicated TDH for each flow conditions. Additional head developed if any shall be killed by control valve in BHEL scope piping.

5.2 As per datasheet A of section D of this volume, design parameters are to be used for basic design, however other three conditions (condition I, II & III) are also to be covered under pump continuous operating range. Pump guarantees are to be furnished for operating condition II flow (i.e. 220 Cub M/hr. flow). For rated duty temperature, pump suction pressure & pump total dynamic pressure developed (to be indicated by bidder).

5.3 Pump characteristic curves (Q vs H, Q vs. Power, Q vs. Eff., Q vs. NPSHr etc) are to be furnished indicating the all four duty condition points and pump output points for flow of all four conditions.

5.4 Design & contructional feature to be considered in addition to those mentioned in datasheet A of section D Vol II B for Drip pumps for YERAMARAS Project:

Thrust Bearing: Thrust bearing for combined thrust load of pump and motor with a rigid coupling between pump and motor or individual thrust bearings for pumps and motor with a flexible coupling between motor and pump.

Impeller/Casing Design: Closed and non overloading type impeller with wear rings on pump bowls.

Motor Bottom level: Bottom of motor to be above zero meter by suitably considering the pit level and motor stool dimensions.

Critical speed: First critical speed in water shall not be within 20% of design speed.

Peripheral speed at the eye of the impeller: Not to exceed 20m/sec.

Suction specific speed: Suction specific speed of first stage impeller not to exceed 11,000 U.S. units based on 3% head break of that impeller at design point.

First stage impeller life: Life due to wear due to cavitation of first stage impeller not less than 40,000 running hours.


Interchangeability: Complete interchangeability in all respect of the pumps and their components.

The pump internals to be capable of being liftedout of casing after removal of motor and disconnecting flange but not the discharge piping.

5.5 Bid Evaluation Criterion

The bids received shall be evaluated for power consumption at inlet to the motor for flow w.r.t condition II viz 220 cub.M/hr.at rated temperature and suction pressure, 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.

$$KW = (Q \times H \times C) / (P \times M \times 367.2)$$
Where Q = Rated capacity M3/hr
H = Developed TDH, MWC (as indicated in schedule of performance guarantee)
P = Pump Efficiency
M = Motor Efficiency = 92% for HT motor supplied by BHEL
C = specific gravity.
The lowest aux. power indicated among all the recommended bidders shall be treated as base aux. power for bid evaluation.

	TECHNICAL SPECIFICATIONS SPECIAL PROCESS VERTICAL PUMP	SPECN. NO.:	PE-TS-362 -165-N001		
		VOLUME:	IIB	SECTION:	C1
		REV. NO.	0	DATE:	05.02.13
<p>5.6 <u>Liquidated Damages for shortfall in Guaranteed KW</u></p> <p>The above guaranteed power consumption shall be demonstrated by the successful bidder during performance testing at works. Since suction temperature & pressure as per rated condition will not be achievable at works, therefore during testing the guaranteed auxiliary power indicated in schedule of performance Guarantee shall be corrected by considering specific gravity correction i.e. dividing the guaranteed auxiliary power by specified specific gravity. Same shall be indicated in schedule of performance Guarantee also.</p> <p>For pumps with HT drives, the power consumption shall be compared with the reworked guarantee power consumption, defined as per note no. 2 of Cl. 4.02.00 of sec D of this volume for the purpose of shortfall.</p> <p>The liquated 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.</p>					




TECHNICAL SPECIFICATIONS
SPECIAL PROCESS VERTICAL
PUMP

SPECN. NO.: PE-TS-362 -165-N001

VOLUME:	IIB	SECTION:	D
REV. NO.	0	DATE:	05.02.13

SECTION D

STANDARD TECHNICAL SPECIFICATIONS STANDARD TECHNICAL SPECIFICATIONS FOR PUMPS

	TECHNICAL SPECIFICATIONS SPECIAL PROCESS VERTICAL PUMP	SPECN. NO.:		PE-TS-362 -165-N001		
		VOLUME:		IIB	SECTION:	D1
		REV. NO.		0	DATE:	05.02.13

SECTION D1

STANDARD TECHNICAL SPECIFICATIONS FOR VERTICAL PUMPS NO. PE TS-179-07

DATA SHEET A FOR VARIOUS PROJECTS ALONGWITH LIST OF MANDATORY SPARES (IF APPLICABLE) & WATER ANALYSIS

DATA SHEET C

QUALITY PLAN



TITLE:

**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07

VOLUME: II B

SECTION: D

REV. NO. 03

DATE: 16.07.2012

SHEET 1 of 16

1.00.00 GENERAL INFORMATION

1.01.00 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.

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'.

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.



TITLE:

**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07

VOLUME: II B

SECTION: D

REV. NO. 03

DATE: 16.07.2012

SHEET 2 of 16

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 A.


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.
- e) Thrust bearing temp. 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.

	TITLE: STANDARD TECHNICAL SPECIFICATION VERTICAL PUMPS	SPECIFICATION NO. PES-179-07	
		VOLUME: II B	
		SECTION: D	
		REV. NO. 03	DATE: 16.07.2012
		SHEET 3 of 16	
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 (enclosed in Volume-III) 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 will be conducted by BHEL at project site to ensure that the pumps meet the specified requirements. In case of any deficiency, the vendor shall rectify the same at site at no additional cost 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.		
	KW = $\frac{Q \times H \times S}{P \times M \times 367.2}$		



TITLE:

**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07

VOLUME: II B

SECTION: D

REV. NO. 03

DATE: 16.07.2012

SHEET 4 of 16

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 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 liquated 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 "D" as well as Data Sheet - A. Wherever there is contradiction between Section D and Data Sheet-A, the latter shall prevail. In the event of any contradiction of section "D" with Section-C, the Section-C will prevail.

5.02.00 The pumps shall be Electric motor driven.

	TITLE: STANDARD TECHNICAL SPECIFICATION VERTICAL PUMPS	SPECIFICATION NO. PES-179-07	
		VOLUME: II B	
		SECTION: D	
		REV. NO. 03	DATE: 16.07.2012
		SHEET 5 of 16	
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 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.		
5.05.00	No negative tolerance shall be permitted in rated capacity & TDH.		
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: <ul style="list-style-type: none">• Purchaser's probes in both DE/NDE bearings of pumps• Key slots on pump shaft with dimensions as specified in Data Sheet A.• Other components as finalized during detailing.• For mounting of above on the HT motors, same shall be taken care by BHEL - Bhopal.		
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.		



TITLE:

**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07

VOLUME: II B


SECTION: D

REV. NO. 03

DATE: 16.07.2012

SHEET 6 of 16

- 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.
- 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 two years. 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.

	TITLE: STANDARD TECHNICAL SPECIFICATION VERTICAL PUMPS	SPECIFICATION NO. PES-179-07	
		VOLUME: II B	
		SECTION: D	
		REV. NO. 03	DATE: 16.07.2012
		SHEET 7 of 16	
5.21.00	If water handled by pump is sea water/ dirty/ not suitable for lubrication/ cooling:		
5.21.01	<p>The bearing lubrication/cooling may be specifically reviewed by bidders for the suitability with water analysis enclosed with Data Sheet-A of this section.</p> <p>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.</p> <p>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.</p>		
5.21.02	<p>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.</p> <p>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:</p> <ul style="list-style-type: none">• 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 Sintex tank, 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.		



TITLE:

**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07

VOLUME: II B

SECTION: D

REV. NO. 03

DATE: 16.07.2012

SHEET 8 of 16

- 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.
- 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-C1 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-C1 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 in the base price of the pump, unless specified otherwise in Sec-C of the specification or NIT.

7.00.00 OTHER REQUIREMENTS:

	TITLE: STANDARD TECHNICAL SPECIFICATION VERTICAL PUMPS	SPECIFICATION NO. PES-179-07	
		VOLUME: II B	
		SECTION: D	
		REV. NO. 03	DATE: 16.07.2012
		SHEET 9 of 16	
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.		
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 this section.		

	TITLE: STANDARD TECHNICAL SPECIFICATION VERTICAL PUMPS	SPECIFICATION NO. PES-179-07	
		VOLUME: II B	
		SECTION: D	
		REV. NO. 03	DATE: 16.07.2012
		SHEET 10 of 16	
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 this section.		
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 attached to this section, 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		



TITLE:

**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07

VOLUME: II B

SECTION: D

REV. NO. 03

DATE: 16.07.2012

SHEET 11 of 16

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.

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.



TITLE:

**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07

VOLUME: II B

SECTION: D

REV. NO. 03

DATE: 16.07.2012

SHEET 12 of 16

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**

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.

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-C 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.

a) 15% margin over the pump shaft input power at the rated duty point.

	TITLE: STANDARD TECHNICAL SPECIFICATION VERTICAL PUMPS	SPECIFICATION NO. PES-179-07	
		VOLUME: II B	
		SECTION: D	
		REV. NO. 03	DATE: 16.07.2012
		SHEET 13 of 16	
<p>b) 5% margin over the maximum pump shaft input power required within the 'Range of Operation'.</p> <p>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.</p>			
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 :			
<ul style="list-style-type: none">• 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:			



TITLE:

**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07

VOLUME: II B

SECTION: D

REV. NO. 03

DATE: 16.07.2012

SHEET 14 of 16

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

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



TITLE:

**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07

VOLUME: II B

SECTION: D

REV. NO. 03

DATE: 16.07.2012

SHEET 15 of 16

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 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 Annexure to Data Sheet-C.

12.00.00 The various Sections-C's & D'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 within 2 weeks from placement of LOI's in the event of order.

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 here only 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 here only and further resubmission of same to



TITLE:

STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS

SPECIFICATION NO. PES-179-07

VOLUME: II B

SECTION: D

REV. NO. 03

DATE: 16.07.2012

SHEET 16 of 16


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.

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 Vol. III of specn.).
- 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 Vol. III of specn.).
- d) Technical deviation schedule (if reqd.) (enclosed at Vol. III of specn.).
- 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.

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.

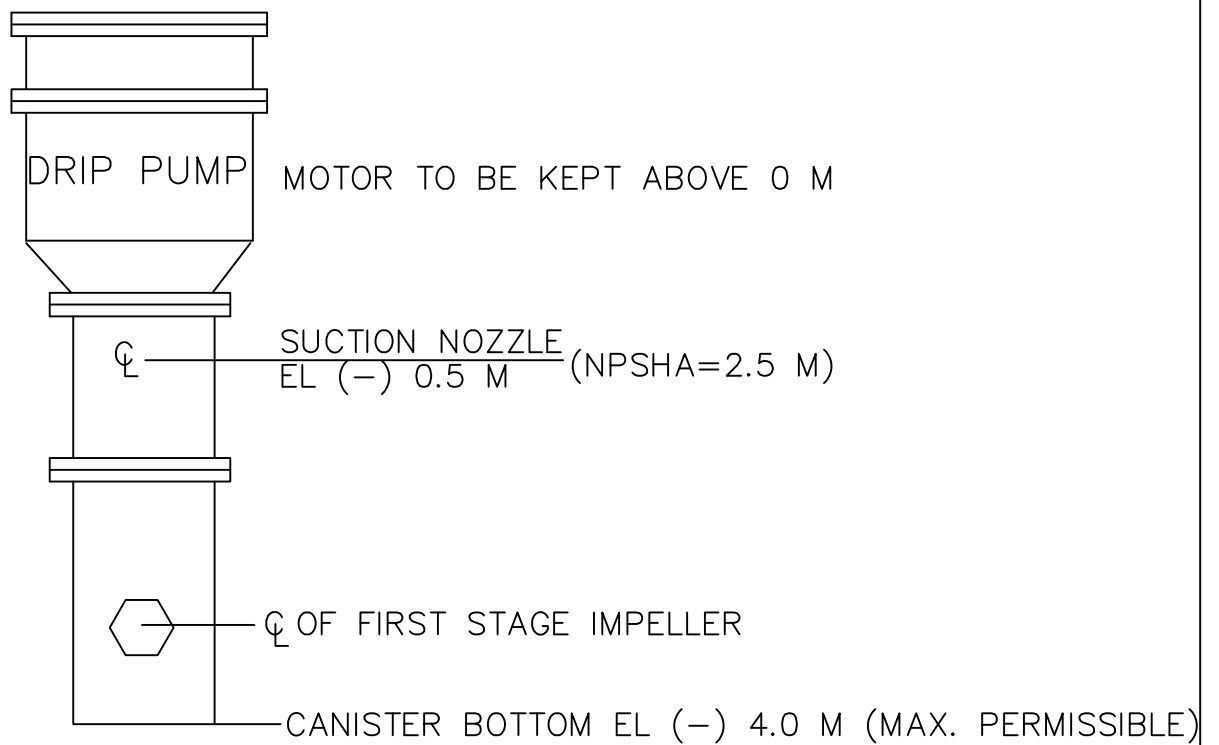
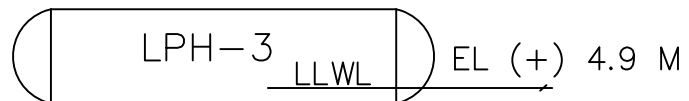
	DATA SHEET - A		SPECIFICATION NO.: PE-TS- 362 -165-N001	
	DRIP PUMPS		REV. NO.:00	05.02.13
	YERMARUS 2X800 MW		VOLUME : II B	SECTION : D
Sl. No.	Description	DRIP PUMPS		
1.0	General			
1.1	Number of pumps	Total four (1 W + 1 S for each Unit)		
1.2	Location indoor/outdoor	Indoor		
1.3	Duty	Continuous.		
1.4	Parallel operation	No		
1.5	Drive	Constant squirrel cage induction motor with maximum speed of 3000 rpm (synchronous). Pump shall be suitable to meet the installation criteria as shown in Sheet 3 of 3.		
1.6	Direct drive	Yes		
1.7	Drive included in pump supplier scope	No		
1.8	Motor designed for end of the curve operation with discharge valve open	Yes		
2.0	Pump Design			
2.1	Design pressure	(1) Bowl and discharge component design pressure shall correspond to shut off head at 51.5 Hz. and operating specific gravity and maximum suction condition. (2) suction component shall be designed for 8 ata and full vacuum.		
2.2	Pump type	Vertical, multistage, canister type, centrifugal, diffuser type		
2.3	Pump Design Code	HIS (latest edition)		
2.4	Sealing arrangement	As per manufacturer standard to prevent air ingress even when the pump under shutdown		
2.5	Liquid handled	Condensate in saturated condition		
2.6	Specific gravity	Refer sheet 2 of 3 at various operating conditions		
2.7	Design Capacity	270 CubM (refer sheet 2 of 3 for flow at various operating conditions)		
2.8	Design TDH (total dynamic head)	220 MLC (refer sheet 2 of 3 for head at various operating conditions)		
2.9	NPSHA at centre line of suction flange	2.5 M (Refer Sheet 3 of 3)		
2.10	NPSHR	NPSH (R) at 3% head drop shall not be more than half the NPSH(A) at design flow,i.e. NPSHa/NPSHr >=2. Bidder to conduct NPSH Test on one pump as per Approved QAP.		
2.11	Suction strainer (loose supply by pump supplier)	Simplex basket type (Qty. 1 no for each pump)-To be installed by BHEL in suction piping		
2.12	Free flow area of strainer element	5 times the inlet cross sectional area of the connecting pipe		
2.13	Maximum pressure drop in suction strainer clean condition at design flow	0.1 Kg/Sqcm		
2.14	Max allowable pressure drop in suction strainer 50% clogged condition at design flow	0.15 Kg/Sqcm		
2.15	Suction piping	273 x 6.35		
2.16	Discharge piping	219.1 x 8.18		
2.17	End connections (pump/ strainer)	Discharge and suction connection of weld neck type, raised steel flange as per ANSI B 16.5.		
3.0	Material of Construction			
3.1	Canister/ suction bell mouth	Carbon steel as per IS: 2062 Gr. B or equiv.		
3.2	Casing/Impeller & Diffuser/Shaft & Sleeves/Wearing Rings	12% chromium stainless steel as per ASTM or equiv.		
3.3	Base Plate	Carbon Steel as per IS: 2062 Gr. B or equiv.		
3.4	Suction strainer casing	Carbon Steel as per IS: 2062 Gr. B or equiv.		
3.5	Suction strainer Internals	Strainer to be constructed of 16 gauge perforated stainless steel (304 grade) and wrapped with stainless steel (316 grade) screen		
4.0	Performance curve	Characteristic curve of pumps should be continuously rising type with decrease in flow and shut-off head shall be between 115% to 130% of TDH of design point.		
5.0	Motor rating	Maximum of the following : (a) Requirements specified at clause 9.09.00 of section D and (b) Motor rating at 50 deg. C ambient temperature shall not be less than the maximum load demand of its driven equipment in its entire operation at the frequency variation from 47.5 Hz. To 51.5 Hz. and motor shall not be over loaded during any mode of operation of driven equipment.		
6.0	Permissible tolerance in rated capacity & TDH	No negative tolerance		
7.0	Type test	NPSH (R) test on one drip pump shall be carried out.		
8.0	Noise Level	85 dBA at 1m distance in any direction for pump		
9.0	Mandatory Spares	NA		
10.0	Bid Evaluation	YES		
10.1	Bid Evaluation Rate	@ Rs 4.75 lac per KW		
10.2	Motor efficiency for Bid evaluation	92%		
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 all HT motor driven pumps, bidder shall provide key slots of dimensions 30mm L x 15 mm W x 3mm D on each pump shaft or some other suitable location which shall be confirmed during detail engineering by BHEL.			
3	For items stated as not applicable by bidder in their Bid, shall have to be supplied without any cost implication to BHEL in the event they are found to be applicable during detail engineering stage.			

BHEL PEM	DATASHEET A				SPEC. NO: PE-TS-362-165-N001	
	DRIP PUMP PARAMETERS					
	PROJECT TITLE : 2X800 MW YERMARUS STPP				SHEET NO.: 2 OF 3	
	1.0 Arrangement 2 x 100 % per Unit					
	2.0	Parameters	Conditions			
			Design Condition	Condition I	Condition II	Condition III (capability check)
	(i)	Flow through pump (m ³ /hr)	270	230	220	310
	(ii)	TDH (MLC)	220	230	210	210
	(iii)	Specific gravity	0.9334	0.9351	0.9351	0.9392
	(iv)	Suction pressure (kg/cm2a)	3.10	2.94	2.94	2.53
	(v)	Suction temperature (°C)	132.3	130.3	130.3	125.5



RPCL – 2X800 MW TPS

DRIP PUMP ELEVATION





TECHNICAL SPECIFICATIONS
SPECIAL PROCESS VERTICAL
PUMPS
DATA SHEET - C

SPECN. NO.: PE-TS-362 -165-N001

VOLUME:	IIB	SECTION:	D1
REV. NO.	0	DATE:	05.02.13

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

- 1.0 Drawings/documents submission schedule, from the date of LOI shall be as per Sec-C1 of this volume. The successful bidder shall submit following drawings/ documents.
- 1.1 Datasheet for the equipment (Pump/ Motor)
- 1.2 Fully dimensioned outline general arrangement drawings of the pump and motor assembly. This drawing should include foundation base plate and sole plate details as applicable, civil foundation and anchor bolt details and loading data, points of connections of external piping and cables and mounting of devices furnished by the supplier.
- 1.3 Cross sectional drawing of the equipment showing the details of assembly of components and their material of construction with standard applicable codes.
- 1.4 Characteristic curves of pump showing the following:
 - a) Flow Vs Head
 - b) Flow VS Power
 - c) Flow Vs Efficiency
 - d) Flow Vs NPSHR
- 1.5 Operation and maintenance manual
- 1.6 Lubrication arrangement drawings for external lubrication.
- 2.0 Within the stipulated time period as per vendor's drawings/ documents schedule, the following shall be submitted but not later than one month before 1st dispatch.
 - a) Drawings of components & details as deemed necessary.
 - b) Instruction manual for erection, operation & maintenance.
 - c) Storage instruction.
- 3.0 Before despatch of the equipment the bidder shall furnish the following.
 - a) Material test certificates.
 - b) Shop test reports & certificates.
- 4.0 Distribution of drawings / documents for all projects:

The no. of drawing/ documents to be submitted by the successful bidder, after the award of the contract shall be intimated after award of contract.



BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN

Rev-01

QUALITY PLAN FOR MISCELLANEOUS PUMPS

PROJECT TITLE
QUALITY PLAN NUMBER
ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL)

PE-QP-999-100-N004
SE-QP-999-100-N004
PE-V7-XXX-100-N004

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		
1	2	3	4	5	6	7	8	9	P	W	V			
MATERIALS CONTROL													11	
1.1	CASINGS (INCLUDING BOWLS,DIFFUSERS, STAGE BODIES, DISCH HEAD (IF CAST)), ETC. - (AS APPLICABLE) AND IMPELLER	MECHANICAL AND CHEMICAL PROPS	OR	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- HARDNESS DIFFERENCE BETWEEN CASING / IMPELLER AND WEARING RING	MA MA	MECHANICAL AND CHEM. ANALYSIS LAB. TEST	ONE/HEAT/BATCH 100%	APPROVED CS DRAWING/DATA SHEET APPROVED CS DRAWING/ DATA SHEET	RELEVANT MATERIAL SPECN. 50 BHN MIN.	LAB REPORT/ MTC LAB. REPORT	3/2. 3/2.		2,1 2,1			
1.3	BARS/FORGINGS FOR SHAFTS, LINE SHAFTS	1.PHYSICAL & CHEMICAL PROPS 2.DIMENSIONS 3.INTERNAL DEFECTS FOR 40MM & ABOVE DIA SHAFTS.	CR CR CR	1.MECHANICAL & CHEMICAL ANALYSIS. 2.MEASUREMENT 3.ULTRA SONIC TEST	1/CAST OR 1/BARS 100% 100%	APPROVED CS DRAWING/DATA SHEET MFR. DRAWING ASTMA388 B.W.E. LOSS OF ECHO 100%	RELEVANT MATERIAL SPECN. MFR. DRAWING DEFECT ECHO MAX 20% OF BACK WALL ECHO 100% MAX	MILL T.C. OR LAB REPORT INSP.REPORT NDT CERTIFICATE	3/2. 3/2. 3/2.		2,1 2,1 2,1			
1.4	STRESS RELIEVING/HEAT TREATMENT OF CASTING OF ALL ABOVE (IF APPLICABLE) / SOLUTION ANNEALING OF SS CASTING	1. VARIIFICATION OF HT CHART 2. IGC TEST FOR SS CASTING	MA MA	VERIFICATION OF SR/HT CHART LAB. TEST	ALL BATCHES ONE SAMPLE/ HT BATCH	RELEVANT MATERIAL SPECN. ASTM A 262	DO- ASTM A 262 Gr A	CORRELATED SR/HT CHARTS LAB. REPORT	3/2. 3/2.		2,1 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./MFRG./ APPROVED DOCS	MFR T.C OR LAB. REPORT	3/2.		2,1			
BHEL													BIDDER / VENDOR	
NAME														
SIGNATURE														
DATE														
PARTICULARS														
													BIDDER/VENDOR SEAL	



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						
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										
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. 10	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.	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	
2.3	IMPELLER	DYNAMIC BALANCING	CR	DYNAMIC BALANCING	100%	ISO 1940	ISO 1940 Gr 6.3	BALANCING CERTIFICATE	3/2. 2.1	WITNESSING ONLY FOR SIZE GREATER THAN 10KW
2.4	ACCESSIBLE SURFACES, DIFFUSERS	DP TEST	MA	DP TEST ON M/CED AREA	100%	APPENDIX 8 OF ASME SEC. VIII DIV. 1	NDT CERTIFICATE	NDT CERTIFICATE	3/2. 2.1	WITNESS BY BHEL & VERIFICATION BY CUSTOMER
2.5	WERING RING, SHAFT SLEEVES, CASING	DP TEST	MA	DP TEST ON M/CED AREA	100%	APPENDIX 8 OF ASME SEC. VIII DIV. 1	NDT CERTIFICATE	NDT CERTIFICATE	3/2. 2.1	WITNESS BY BHEL & VERIFICATION BY CUSTOMER
2.6	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				NAME						
SIGNATURE				SIGNATURE						
DATE				DATE						

Prepared By
AJAY JAIN
23-07-2012

Reviewed By
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23-07-2012

Approved By
I. J. SINGH
23-07-2012


BIDDER/VENDOR SEAL




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				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
1	2	3	4	5	6	7	8	9	P W V	10 11
2.7	FABRICATED COMPONENTS									
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		DATE				

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SIGN.
DATE

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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 4 OF 6				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		2.1
2.7.8	DICHAARGE 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	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
3.3	COMPLETE PUMP ASSEMBLY	COMPLETENESS, CORRECTNESS, CLEANLINES, FREELINESS, 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		

Prepared By
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23-07-2012



BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN

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QUALITY PLAN FOR MISCELLANEOUS PUMPS

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	
SHEET 5 OF 6													
ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL)													
SYSTEM													
BIDDER/VENDOR													
PROJECT TITLE													
QUALITY PLAN NUMBER													
BHEL													
PARTICULARS													
NAME													
SIGNATURE													
DATE													
BIDDER/VENDOR SEAL													

FINAL INSPECTION, TESTS & PACKING DESPATCH CONTROL													
S. No.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS			
1													
4													
4.1	PUMP WITH JOBSHIP 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 9.6.4-2008 (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.			
4.2	STRIP DOWN AFTER PERFORMANCE TEST	1. UNDUWEAR TEAR AND RUBBING	MA	VISUAL EXAM AFTER STRIPPING	1/MODEL	NO UNDUWEAR TEAR & RUBBING ON IMPELLER & WEAR RING		INSPECTION REPORT	3/2, 1	IF SPECIFIED or INSISTED BY CUSTOMER.			
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		INSPECTION REPORT	3/2, 1	WITNESS REQUIRED ONLY WHEN ABNORMAL SOUND OBSERVED DURING PERFORMING TEST.			

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		



Rev-01

SYSTEM	ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL)
SHEET 6 OF 6	

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

- 1.A5 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- INCREASE 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.

P-PERFORM, W-WITNESS, V-VERIFICATION

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