

**TISHREEN TPP, 2X200 MW  
YERAMARAS STPS, 2 X 800 MW**


**VOLUME -IIB**

**TECHNICAL SPECIFICATION  
FOR  
SPECIAL PROCESS VERTICAL PUMP**

**Specification No. : PE-TS-323 /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-323/362 -165-N001	
			REV. NO. 0	DATE: 10.08.11

1.0 The tender document contains three (3) volumes. The bidder shall meet the requirements of all the three volumes.

1.1 Volume I - CONDITIONS OF CONTRACT

This consists of four parts as below:

Volume - I A : This part contains instructions to bidders for making bids to BHEL.

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.

Volume - I C : This part contains special conditions of contract.

Volume - I D : This part contains commercial conditions for erection and commissioning site work, as applicable.

1.2 Volume II - TECHNICAL SPECIFICATIONS

Technical requirements are stipulated in Volume II which comprises of:

Volume - II A : General Technical Conditions

Volume - II B : Technical specification including drawings, if any

1.2.1 Volume - II B :

This volume is sub-divided into following sections:

Section - A : This section outlines the scope of enquiry.

Section - B : This section provides "Project Information"

Section - C : This section indicates technical requirements specific to the contract, not covered in Section-D.

Section - D : This section comprises of technical specifications of equipments complete with data sheet A, B & C.

Data sheet - A specifies data and other requirements pertaining to the equipment.

Data sheet - B specifies data to be filled by the bidder (Data Sheet B is contained in Volume - III)

Data sheet - C indicates data documents to be furnished after the award of contract as per agreed schedule by the vendor (as applicable).

1.2.2 Volume - III TECHNICAL SCHEDULES

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.

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-323/362 -165-N001

REV. NO.

0

DATE:

10.08.11

INDEX

SECTION TITLE

A SCOPE OF ENQUIRY

B PROJECT INFORMATIONS

B1 TISHREEN TPP, 2X200 MW

B2 YERMARAS STPS, 2 X 800 MW

C SPECIFIC TECHNICAL REQUIREMENTS FOR

C1 PUMPS

C2 MOTORS

D STANDARD TECHNICAL SPECIFICATIONS FOR

D1 PUMPS

- STANDARD TECHNICAL SPECIFICATIONS FOR VERTICAL PUMPS- NO. PE-TS-179-07
- DATA SHEETS-A FOR ALL PROJECTS ALONGWITH RESPECTIVE LIST OF MANDATORY SPARES (IF APPLICABLE) & WATER ANALYSIS.
- DATA SHEET - C
- STANDARD QUALITY PLAN FOR PUMPS

D2 MOTORS

- STANDARD TECHNICAL SPECIFICATION FOR MOTORS
- DATA SHEET-A FOR ALL PROJECTS
- STANDARD QUALITY PLAN FOR MOTORS




TECHNICAL SPECIFICATIONS  
SPECIAL PROCESS VERTICAL  
PUMP

SPECN. NO.: PE-TS-323/362 -165-N001

VOLUME:	IIB	SECTION:	A
REV. NO.	0	DATE:	10.08.11

**SECTION A**

**SCOPE OF INQUIRY**

	TECHNICAL SPECIFICATIONS SPECIAL PROCESS VERTICAL PUMP	SPECN. NO.:	PE-TS-323/362 -165-N001		
		VOLUME:	IIB	SECTION:	A
	SCOPE OF ENQUIRY	REV. NO.	0	DATE:	10.08.11

**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 (Supervision of erection & commissioning for Tishreen Project drain pumps and for Yeramarus Project Drip Pumps, 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.

The bidder's scope shall also include any other services, etc. if called for in the succeeding sections of the specification.

1.2 The pumps covered under this specification shall be Vertical canister type pumps.

**Note:**

Pumps for both projects may be combined together for bid evaluation if stated in NIT.

The bidder shall include complete supplies for the Project/Group as above in his scope. Part supplies offered for the Project/Group shall disqualify the bidders offer for that Project/Group (as applicable).

**1.3 FOR YERAMARAS PROJECT:**  
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.

**FOR TISHREEN PROJECT:**  
> The pumps shall be erected & commissioned under the bidder's supervision for correctness of their installation, alignment, commissioning etc. at site. The Daily allowance (DA) charges for supervision of erection & commissioning at site for total of 7 mandays shall be included by bidder in his base price, itself. For other details viz. To & fro air fares, local movement, accommodation on shared basis, food etc, please refer GCC/SCC.  
> The pumps shall be properly packed with sea worthy packing for delivery/transportation.

1.4 The pumps and drives covered under this specification for various projects are as per annexure I. 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 II.


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.

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.

1.6 Electrical scope between BHEL and Vendor for Miscellaneous pumps and drives of this specification shall be as per annexure III.

**2.0 GENERAL TECHNICAL INSTRUCTIONS**

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.

	TECHNICAL SPECIFICATIONS SPECIAL PROCESS VERTICAL PUMP	SPECN. NO.: PE-TS-323/362 -165-N001		
	SCOPE OF ENQUIRY	VOLUME:	IIB	SECTION: A
		REV. NO.	0	DATE: 10.08.11


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.

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.

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.

2.5 ***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.***

2.6 Unpriced copy of the price bid shall be furnished alongwith the technical bid.

	<b>TECHNICAL SPECIFICATIONS SPECIAL PROCESS VERTICAL PUMP</b>	SPECN. NO.: PE-TS-323/362 -165-N001			
		VOLUME:	IIB	SECTION:	A
		REV. NO.	0	DATE:	10.08.11
<b>Annexure I</b>					
<b>List of Miscellaneous Pumps and drives for various projects:</b>					
<b>1.0 YERMARAS STPS, 2 X 800 MW</b>					
<b>Sl. No.</b>	<b>Pump Description</b>	<b>Total Qty.</b>	<b>Type of Pumps</b>		
1	DRIP PUMPS	4 nos.	VERTICAL CANISTER TYPE		
<b>2.0 TISHREEN TPP, 2X200 MW</b>					
<b>Sl. No.</b>	<b>Pump Description</b>	<b>Total Qty.</b>	<b>Type of Pumps</b>		
1	DRAIN PUMPS	4 nos.	VERTICAL CANISTER TYPE		



TECHNICAL SPECIFICATIONS  
SPECIAL PROCESS VERTICAL  
PUMP

SPECN. NO.: PE-TS-323/362 -165-N001

VOLUME: IIB SECTION: A

REV. NO. 0 DATE: 10.08.11

Annexure II

Following HT drives for various projects, irrespective of Motor ratings shall be issued free, by BHEL:

- 1 YERMARAS STPS, 2 X 800 MW
- DRIP PUMPS



# ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

## ANNEXURE - III

PROJECTS: 2x200MW TISHREEN

PACKAGE: PUMPS

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	LT MCC	BHEL/ CUSTOMER	BHEL/ CUSTOMER	DOL starters for motors and 380V supply feeders required if any. The starters for motors shall be located in MCC. Vendor to furnish the load list.
2	Local push button station (for motors)	BHEL/ CUSTOMER	BHEL/ CUSTOMER	Located near the motor
3	Power cables, ordinary control cables and screened control cables between equipments supplied by vendor.	Vendor	Vendor	
4	Power cables, ordinary control cables and screened control cables between equipments supplied by vendor & BHEL/CUSTOMER	BHEL/ CUSTOMER	BHEL/ CUSTOMER	
5	Any special type of cable like compensating, Co-axial, prefab, MICC and fibre optical	Vendor	Vendor	
6	Cabling material (cable trays, accessories and cable tray-supporting system, conduits, M Boxes/J Boxes) for cabling between equipments supplied by vendor and BHEL/CUSTOMER.	BHEL/ CUSTOMER	BHEL/ CUSTOMER	
7	Conduits and conduit accessories for cabling between equipments by vendor	Vendor	Vendor	Cabling shall be through conduits. However, vendor can use the trunk routes available for laying of cables.
8	Equipment earthing.	BHEL/ CUSTOMER	BHEL/ CUSTOMER	
9	Motors with Base frame and fixing hardware for motors.	Vendor	-	Makes shall be subject to BHEL/CUSTOMER approval at contract stage.
10	a) Input cable schedules b) Cable interconnection details. c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for control cables for vendor-supplied equipment (soft copies in the BHEL/CUSTOMER cable schedule format) shall be furnished during detail engineering by vendor.
11	Equipment layout drawings.	Vendor	-	Layout details between vendor supplied equipment and installation drawings by vendor
12	Cable glands and lugs for equipment supplied by vendor	Vendor	-	1. Double compression Ni-Cr plated brass glands. 2. Solder less crimping type heavy-duty tinned copper lugs for power cables. 3. Heavy duty tinned copper lugs for control cables.

Note- All QP's shall be subject to approval of BHEL/ Customer after award of contract.



TECHNICAL SPECIFICATIONS  
SPECIAL PROCESS VERTICAL  
PUMP

SPECN. NO.: PE-TS-323/362 -165-N001

VOLUME: IIB SECTION: B

REV. NO. 0 DATE: 10.08.11

**SECTION B**

**PROJECT INFORMATION**

**B1 -TISHREEN TPP, 2X200 MW**  
**B2-YERAMARAS STPS, 2 X 800 MW**



TECHNICAL SPECIFICATIONS  
SPECIAL PROCESS VERTICAL  
PUMP

SPECN. NO.: PE-TS-323/362 -165-N001

VOLUME: IIB

SECTION: B1

REV. NO. 0

DATE: 10.08.11

**SECTION B-1**

**PROJECT INFORMATION**

**TISHREEN TPP, 2X200 MW**

Dated: 05-Feb-2010

**2X200 MW TISHREEN TPP EXTN, SYRIA**

**PROJECT INFORMATION-REV00**

1.	Owner	PUBLIC ESTABLISHMENT OF ELECTRICITY FOR GENERATION AND TRANSMISSION (PEEGT)
2.	Project	2X200 MW TISHREEN TPP EXTENSION
3.	Owner's consultant	NO CONSULTANT TILL DATE
4.	Location	50kms east of Damascus.
5.	Nearest Airport	Damascus International Airport
6.	Nearest Railway Station	-----
7.	Access to site	<p>a. <u>Through sea</u>: Tartous Port</p> <ul style="list-style-type: none"> <li>Distance of site: 300 kms approximately</li> </ul> <p>b. <u>By Air</u> : Damascus Airport</p> <ul style="list-style-type: none"> <li>Distance from site : 50kms</li> </ul>
8.	Site data	
A	Altitude	605.7m above Mean Sea Level
B	Ambient Air Temperature	
1.	Design maximum	

	(a)Equipments	45°C
	(b)Dry Cooling Tower	40°C
2.	Design Minimum	-11°C
<b>C</b>	<b>RELATIVE HUMIDITY</b>	
	Design Relative Humidity	56%
<b>D</b>	<b>RAINFALL</b>	
1.	Maximum Intensity of Rainfall	25 mm/hr
<b>E</b>	<b>WIND VELOCITY &amp; PRESSURE</b>	
1.	Basic Wind speed	35m/s
<b>F</b>	<b>SEISMIC ZONE</b>	UBC 1997,Zone-3
<b>9.0</b>		
<b>A</b>	Max. Ambient temperature for design of electrical equipment in non-air conditioned area	45 °C
<b>B</b>	Min. Ambient temperature for Design of electrical equipment in non-air conditioned area	-11 °C
<b>10.0</b>		
<b>A</b>	AC Voltage Level For power generation	15.75 kV± 5 %, 3 phase, 50 Hz (-5 to +3%)
<b>B</b>	AC Voltage Level For power evacuation & start-up / standby power	230 kV± 5 %, 3 phase, 50 Hz (-5 to +3%)
<b>C</b>	AC Voltage Level For Aux Power Distribution	6.3 KV, 3 phase, 3 wire, 50 Hz 400 V, 3 phase, 4 wire, 50 Hz 220 V, 1 phase, 2 wire, 50 Hz
<b>D</b>	Voltage & Frequency variation	6.3 KV / 400 V/ 220 V AC systems and the equipments connected on these systems shall be suitable for Voltage variation of ± 10 %, frequency variation of (+) 3% to (-) 5% and 10% combined variation (sum of absolute values) of voltage and frequency.
<b>E</b>	The rated voltage level for motors shall be as follows:	

	<ul style="list-style-type: none"> <li>• Above 200 kW</li> <li>• Above 200 W &amp; upto 200 kW</li> <li>• Upto 200 W</li> </ul>	<ul style="list-style-type: none"> <li>• 6.0 KV</li> <li>• 380 V</li> <li>• 220 V</li> </ul>
<b>F</b>	AC supply voltage for space heating, lighting and small power distribution	220 V, 1ph, 50 HZ
<b>G</b>	AC control voltage	110 V, 1ph, 50 HZ
<b>H</b>	UPS Voltage	230 V, 1ph, 50 Hz
<b>I</b>	DC Voltage for motor, protection, control and emergency lighting	220 V
<b>J</b>	DC Voltage for control & instrumentation	24 V
<b>K</b>	AC emergency supply	400 V, 3 Ph, 3 wire
<b>L</b>	DC Voltage variation	187 V - 242 V for 220 V DC
<b>11.0</b>	<b>Fault levels</b>	
<b>A</b>	230 KV System	40 kA for 1 sec
<b>B</b>	6.3KV System	40 kA for 1 sec
<b>C</b>	400V System	50 kA for 1 sec for PCC /PMCC / MCCs with breaker incomer
		50 kA for 0.2 sec for MCCB protected MCCs/DBs
<b>D</b>	220V DC System	15 kA
<b>12.0</b>	<b>GROUNDING</b>	
<b>A</b>	230 KV System	Solidly grounded
<b>B</b>	Generator	High resistance grounded through distribution transformer, transformer secondary loaded with resistor.
<b>C</b>	6.3KV System	isolated.
<b>D</b>	400 V System	Solidly grounded

<b>E</b>	220V DC System	Ungrounded
<b>F</b>	Diesel Generator	Ungrounded



TECHNICAL SPECIFICATIONS  
SPECIAL PROCESS VERTICAL  
PUMP

SPECN. NO.: PE-TS-323/362 -165-N001

VOLUME: IIB

SECTION: B2

REV. NO. 0


DATE: 10.08.11


**SECTION B-2**


**PROJECT INFORMATION**

**YERAMARAS STPS, 2 X 800 MW**



<b>RPCL/YTPS</b> 	<b>RAICHUR POWER CORPORATION LIMITED</b> <b>YERAMARUS TPS - 2x800 MW</b> <b>PROJECT INFORMATION</b>		<b>SECTION: B</b> <b>VOLUME-II</b> <b>Page 1 of 3</b>
1.0 Owner  2.0 Consultant  3.0 Project Title  4.0 Location  5.0 Nearest Railway  6.0 Nearest Airport  7.0 Nearest Port 8.0 Latitude and Longitude 9.0 Elevation above mean sea level 10.0 <u>Climatic Conditions</u>	: Raichur Power Corporation Ltd 22/23, Sudarshan Complex, IInd floor, Sheshadri Road, Bangalore-560 009 Karnataka, India  : M/s Evonik Energy Services (I) Private Limited,A-29, Sector 16 Noida-201301(UP), India  : 2x800 MW Yeramarus Thermal Power Station  : 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  : Chicksugur Railway Station which is about 2 kms from site.  : Hyderabad around 200 kms  Chennai around at about 470 kms from site. : Latitude - 16° 16' 55.9"N Longitude - 77° 20' 38.6"E : 350-375 meters  <u>(a) 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  <u>(b) Relative Humidity</u> i. Maximum during monsoon : 85% ii. Minimum : 20% iii. Average : 65%		

	<p align="center"><b>RAICHUR POWER CORPORATION LIMITED</b></p> <p align="center"><b>YERAMARUS TPS - 2x800 MW</b></p>	<p>SECTION: B</p> <p>VOLUME-II</p> <p>Page 2 of 3</p>
TITLE	PROJECT INFORMATION	
	<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 : West, South-East, North-West, South-West direction</p> <p>ii. Maximum mean wind : 15.9 Kms / hr (4.42 m/s) speed</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>	

RPCL/YTPS		RAICHUR POWER CORPORATION LIMITED		SECTION: B	
		YERAMARUS TPS - 2x800 MW		VOLUME-II	
TITLE		PROJECT INFORMATION		Page 3 of 3	
<p>(f) AC control &amp; 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&amp;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 <math>\pm 10\%</math> Frequency variation <math>\pm 5\%</math> Combined voltage &amp; frequency variation <math>\pm 10\%</math></p> <p>ii. DC supply : Voltage variation +10% - 20%</p>					



TECHNICAL SPECIFICATIONS  
SPECIAL PROCESS VERTICAL  
PUMP

SPECN. NO.:	PE-TS-323/362 -165-N001		
VOLUME:	IIB	SECTION:	C
REV. NO.	0	DATE:	10.08.11

**SECTION C**

**SPECIFIC TECHNICAL REQUIREMENTS**

**C1: SPECIFIC TECHNICAL REQUIREMENTS FOR PUMPS**

**C2: SPECIFIC TECHNICAL REQUIREMENTS FOR MOTORS**



TECHNICAL SPECIFICATIONS  
SPECIAL PROCESS VERTICAL  
PUMP

SPECN. NO.:

PE-TS-323/362 -165-N001

VOLUME:

IIB

SECTION:

C1

REV. NO.


0

DATE:

10.08.11

**SECTION C1**

**SPECIFIC TECHNICAL REQUIREMENTS FOR PUMPS**

	TECHNICAL SPECIFICATIONS SPECIAL PROCESS VERTICAL PUMP	SPECN. NO.:	PE-TS-323/362 -165-N001		
		VOLUME:	IIB	SECTION:	C1
		REV. NO.	0	DATE:	10.08.11

**SPECIFIC TECHNICAL REQUIREMENTS:**

**1.0 DELIVERY:**

Delivery of miscellaneous pumps from date of LOI, for various projects shall be as per NIT requirement.

The delivery periods shall be as per NIT requirements, considering 6 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.

The drawings to be submitted by bidder in the event of order for each project shall be :

• **Pumps :**

- Technical Data Sheets and Performance Curves.
- GA and Cross Sectional drawings
- Quality Plan

• **Motors :**

- Technical Data Sheets, curves alongwith other motor documents
- Motor GA drawing, terminal details, etc.
- Quality Plan

Drawings submission schedule shall be as follows :

1<sup>st</sup> submission of drawings from date of LOI\* shall be within 25 days.

Every revised submission incorporating comments – Within 15 days.

\* Provided BHEL furnishes HT motor GA drawing (wherever applicable) within 2 weeks from LOI. Bidders to note that HT motors inputs viz. Load Torque vs. speed curves of the pumps, selected motor ratings, rpm, GD<sup>2</sup> value of driven equipment furnished alongwith offer shall be considered final and BHEL may proceed with final motor designs as per same.

Delay in drawing submission from above schedule shall attract liquidated damages @ Rs. 2,500 per drawing/week. 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.

**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:

- 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.

**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:


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	SPECN. NO.:	PE-TS-323/362 -165-N001		
	SPECIAL PROCESS VERTICAL PUMP	VOLUME:	IIB	SECTION:	C1
		REV. NO.	0	DATE:	10.08.11

**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 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.

	<b>TECHNICAL SPECIFICATIONS</b> <b>SPECIAL PROCESS VERTICAL</b> <b>PUMP</b>		<b>SPECN. NO.:</b> PE-TS-323/362 -165-N001	
	<b>VOLUME:</b> IIB		<b>SECTION:</b> C1	
	<b>REV. NO.</b> 0		<b>DATE:</b> 10.08.11	

**5.6 Liquidated Damages for shortfall in Guaranteed KW**  
 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.  
 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.  
 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.





TECHNICAL SPECIFICATIONS  
SPECIAL PROCESS VERTICAL  
PUMP

SPECN. NO.:

PE-TS-323/362 -165-N001

VOLUME:

IIB

SECTION:

C2

REV. NO.

0

DATE:

10.08.11

**SECTION C2**

**SPECIFIC TECHNICAL REQUIREMENTS FOR MOTORS**



**TECHNICAL SPECIFICATION FOR  
PUMPS  
(ELECTRICAL PORTION)**

SPECIFICATION NO. PE-TS-XXX-174-A001  
VOLUME II B  
SECTION-C  
REV 01  
PAGE 1 OF 1  
DATE 24.07.08

**SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL**

**1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER/ PURCHASER**

- 1.1 Scope for supply, and erection & commissioning of various equipment forming part of electrical system for this package shall be as per Annexure-III to Section – A [Scope of Work (Electrical)].
- 1.2 Make of various equipment/ items in the scope of bidder shall be to approval of owner during detailed engineering stage without any commercial implications.
- 1.3 Bidder shall furnish all AC as well as DC loads required for the system at different voltage levels (eg. 415V AC, 380 V, 240 V AC, 220 V DC etc.) of all types, such as motor feeders, supply feeders in PEM format along with the offer.
- 1.4 All electrical equipment shall be suitable for the power supplies, fault levels and climatic conditions indicated in project information enclosed with the specification.
- 1.5 All drawings, data sheets, Quality Plan, calculations, test reports, test certificates, etc. shall be submitted during detailed engineering stage as per formats enclosed. The same shall be subject to approval without any commercial implications.
- 1.6 Technical requirements shall be as per specifications listed in Clause 4.1, 4.2 & 4.3 below.

**3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID**

- 3.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/ quality assurance requirements stipulated. In line with this, the bidder as technical offer shall furnish two signed and stamped copies of the following:
  - a) A copy of this sheet "Electrical Equipment Specification for Sump. Pumps and sheet "Electrical Scope between BHEL and Vendor" with bidder's signature and company stamp.
  - b) List of Erection and Commissioning spares.
  - c) List of Erection & Maintenance tools & tackles.
  - d) Electrical load requirement in the load data format.
- 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.

**4.0 LIST OF ENCLOSURES**

- 4.1 Electrical scope between BHEL & vendor (Annexure-III) of section A of this volume.
- 4.2 Technical specification no. PE-SS-999-506-E101, Data Sheets (A & C) for LT Electric Motors.
- 4.3 Quality Plan for motors.
- 4.4 Load data format (Annexure-II).
- 4.5 Specific electrical requirement for pumps (Annexure- I)

## ANNEXURE III

**SPECIFIC ELECTRICAL REQUIREMENT FOR PUMPS**

SL.NO.	PARAMETERS	UNIT	TISHREEN
	<b>MOTOR</b>		
1	DESIGN AMBIENT TEMP	DEG. C	45
2	VOLTAGE SUPPLY AND VARIATION	VOLT	380V, $\pm 10\%$
3	FREQUENCY WITH VARIATION	Hz	50(+ 3% to - 5%)
4	COMBINED VOLTAGE & FREQUENCY VARIATION		10% (absolute)
5	MAX ACCEPTABLE RATING OF MOTOR AT 380 V	KW	(Upto) 200 KW
6	SYSTEM FAULT LEVEL AND ITS DURATION	KA	50 KA, 1 Sec
7	SUTABILITY OF TERMINAL BOX FOR FAULT LEVEL AND DURATION		50 KA, 0.2 sec
8	CLASS OF INSULATION & TEMP RISE LIMITED TO		Class-F and temp rise limited to Class-B
9	MIN. STARTING VOLTAGE		80%
10	MOTOR RATING FOR SINGLE PHASE SUPPLY		0.2 kW & Below
11	MAXIMUM LOCKED ROTOR CURRENT	% OF FLC	As per IEC-60034
12	ACCEPTABLE NOISE LEVEL	DB	As per IEC-60034
13	TYPE OF STARTER PROVIDED IN MCC		DOL
14	DOP OF ENCLOSURE		IP- 55
15	SPACE HEATER REQUIREMENT	<30kW	30KW & ABOVE
16	PAINT SHADE		During detail engineering
17	SPECIAL REQUIREMENT		TYPE TEST REPORTS MORE THAN 5 YEARS OLD ARE NOT ACCEPTABLE
18	ENERGY EFFICIENT		-



TECHNICAL SPECIFICATIONS  
SPECIAL PROCESS VERTICAL  
PUMP

SPECN. NO.:

PE-TS-323/362 -165-N001

VOLUME:

IIB

SECTION:

D

REV. NO.

0

DATE:

10.08.11

## SECTION D

### STANDARD TECHNICAL SPECIFICATIONS

**D1: STANDARD TECHNICAL SPECIFICATIONS FOR PUMPS**

**D2: STANDARD TECHNICAL SPECIFICATIONS FOR MOTORS**



TECHNICAL SPECIFICATIONS  
SPECIAL PROCESS VERTICAL  
PUMP

SPECN. NO.: PE-TS-323/362 -165-N001

VOLUME:

IIB

SECTION:

D1

REV. NO.

0

DATE:

10.08.11

**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:**  
**VERTICAL PUMPS**  
**STANDARD TECHNICAL SPECIFICATION**

**SPECIFICATION NO.** PES-179-07

**VOLUME :** II B

**SECTION :** D

**REV. NO.** 02 **DATE :** 28.09.2007

**SHEET** 1 of 13

**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 - Rotodynamic special purpose pumps.  |
| 2.01.03 | IS 5639/1970:  | Pumps for handling chemical and corrosive liquids.   |
| 2.01.04 | IS 5659/1970:  | Pumps for process water.   |
| 2.01.05 | IS 6536/1972:  | Pumps handling volatile liquids.   |
| 2.01.06 | IS 9137/1978:  | Code for acceptance 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 general refinery services.   |
| 2.01.11 | Hydraulic Institute Standards of USA (1983).   |  |
| 2.01.12 | PTC 8.2/1965 :   | Power Test Codes - Centrifugal pumps.  |
| 2.02.00 | In case of any contradiction between the above standards and Annexures attached to this section, the stipulations in the Annexures shall prevail and shall be binding on the bidder. |  |



**TITLE:**  
**VERTICAL PUMPS**  
**STANDARD TECHNICAL SPECIFICATION**

**SPECIFICATION NO.** PES-179-07

**VOLUME :** II B

**SECTION :** D

**REV. NO.** 02

**DATE :** 28.09.2007

**SHEET** 2 of 13

**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  
(The bare HT drive motors wherever required supplied as free issue by BHEL refer Cl. 5.08.00 ).
- b) Pump motor coupling along with coupling guard
- c) Common base plates for pump and motor.
- d) Self-contained lubrication system along with all internal piping, valves, fittings, specialties etc. as required.
- e) Counter flanges for suction/ discharge nozzles along with fixing nuts, bolts and gaskets.
- f) Anchor bolts, nuts, seating steel works, etc. as necessary for mounting the pump-motor unit on Civil foundations.
- g) Suitable vent (with valves)/ lifting/ handling attachments for the pump/ motor/ accessories.
- h) Suitable drain connections with isolating valves as applicable.
- i) Supply of first fill of lubricants with toping requirements for one year of operation after commissioning and handing over of equipment.
- j) Set of "Special" Tools & Tackles for Pumps and motors, if any.
- k) Erection and commissioning spares, "on as required" basis.



**TITLE:**  
**VERTICAL PUMPS**  
**STANDARD TECHNICAL SPECIFICATION**

**SPECIFICATION NO.** PES-179-07

**VOLUME :** II B

**SECTION :** D

**REV. NO.** 02

**DATE :** 28.09.2007

**SHEET** 3 of 13

l) Bidder shall provide various drawings, data, calculations, test reports/ certificates, operation and maintenance manuals, As-built drawings, etc. as specified and as necessary.

m) Mandatory spares as specified in Data Sheet-A.

**3.04.00** Services included in Bidder's Scope:

**3.04.01** The pumps shall be guaranteed to meet the performance requirements as specified vide Datasheet – 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** 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.

**3.04.03** 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) HT motors
- 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 specified in Datasheet A per one (1) KW Power consumption, per working pump as follows.

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

Where Q = Rated capacity M<sup>3</sup>/Hr  
H = Rated TDH, MWC  
P = Pump Efficiency  
M = Motor Efficiency.



	<b>TITLE:</b> <b>VERTICAL PUMPS</b> <b>STANDARD TECHNICAL SPECIFICATION</b>	<b>SPECIFICATION NO.</b> PES-179-07	
		<b>VOLUME :</b> II B	
		<b>SECTION :</b> D	
		<b>REV. NO.</b> 02	<b>DATE :</b> 28.09.2007
		<b>SHEET</b> 4 of 13	

**4.02.00** The maximum permissible efficiencies for pumps and motors for Bid Evaluation shall be as indicated in Datasheet - A for various pumps.

No advantage shall be given to bidder for efficiencies quoted higher than the maximum permissible values. However the bids shall be evaluated as above if the efficiencies quoted are lower than specified values.

Note:

1. HT motors efficiencies 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 HT drives 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 appd datasheet of the supplied HT 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 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 above for the purpose of shortfall.

The liquated damages @ twice the specified 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 with section-C, the Section-C will prevail.

**5.02.00** The pumps shall be Electric motor driven.

**5.03.00** The Pumps shall conform to HIS

**5.04.00** The type of Vertical pumps shall be as follows:

- a) Vertical turbine type pumps with 1500rpm. (if no. of stages  $\leq 5$ ) 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



**TITLE:**  
**VERTICAL PUMPS**  
**STANDARD TECHNICAL SPECIFICATION**

**SPECIFICATION NO.** PES-179-07

**VOLUME :** II B

**SECTION :** D

**REV. NO.** 02

**DATE :** 28.09.2007

**SHEET** 5 of 13

- 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 at least 115% of pump rated TDH.
- 5.08.00 All HT motors (bare motors only) shall be supplied as free issue by BHEL through BHEL - Bhopal, based on ratings and torque - speed curve selected by the bidders. The responsibility for satisfactory operation for combined performance of pumps & motors, shall rest with the bidder only as if, the HT Motors has been supplied by the bidder.
- Couplings, base plate, foundation bolts, any other fittings, etc. as required shall be supplied by the bidders only. BHEL - Bhopal shall supply one number of each type of HT motor for shop testing of pumps with job motors. All other motors shall be dispatched by BHEL - Bhopal 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 with dimensions as specified in Datasheet - 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.
- 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 NPSH conditions required without any noise, vibration or cavitation.
- 5.14.00 The prevailing suction pressures for various pumps are indicated in Data Sheet-A for suitable mechanical design of pumps.
- 5.15.00 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.

**TITLE:****VERTICAL PUMPS  
STANDARD TECHNICAL SPECIFICATION****SPECIFICATION NO.** PES-179-07**VOLUME :** II B**SECTION :** D**REV. NO.** 02**DATE :** 28.09.2007**SHEET** 6 of 13

- 5.16.00 Pumps and motors shall run smooth without undue noise and vibration. The vibration shall be within 75 microns for pump - motor set. The noise level shall be limited to 85 dB at distance of 1.0M.
- 5.17.00 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.
- 5.18.00 After installation, the guaranteed values of noise, vibration and parallel operation of pumps shall be tested & 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.
- 5.19.00 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.
- 5.20.00 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.
- 5.21.00 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.
- If water handled by pump is dirty/ not suitable for lubrication/ cooling, the bidder shall provide requisite strainer/ filters, tanks, motorized valves, etc. after the tap off for the required service, the arrangement provided shall be subject to Purchaser's approval.
- 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
- 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.
- 7.03.00 The makes of various bought out items of bidder (i.e. motor, etc.) shall be subject to purchaser's approval in the event of order.



**TITLE:**  
**VERTICAL PUMPS**  
**STANDARD TECHNICAL SPECIFICATION**

**SPECIFICATION NO.** PES-179-07

**VOLUME :** II B

**SECTION :** D

**REV. NO.** 02

**DATE :** 28.09.2007

**SHEET** 7 of 13

**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.

For all the steel surfaces inside the (indoor installation) building, a coat of red oxide primes of min. thickness of 50 microns followed up with under coat of Synthetic Enamel paint of min. thickness of 50 microns shall be applied. the top coat shall consist of two coats each of min. thickness of 50 microns of synthetic enamel paint and thus total thickness shall be min. 200 microns.

**7.05.00 It is mandatory for the bidder to submit alongwith 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 (s) shall be guided by the stipulations as specified in enclosed Data Sheet A with this section.

**8.02.00** Pump (s) shall preferably be designed to have the best efficiency at the specified duty point. Further, the pumps (s) shall be suitable for continuous operation at any point within its ‘range of operation’ as specified in annexures enclosed with this section.

**8.03.00** 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.

**8.04.00** In case the annexures call for parallel operation of the pumps, pumps shall have identical characteristics to ensure equal load sharing and shall ensure trouble free operating of any pump when the other pump (s) working in parallel with it trip.

**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**



**TITLE:**  
**VERTICAL PUMPS**  
**STANDARD TECHNICAL SPECIFICATION**

**SPECIFICATION NO.** PES-179-07

**VOLUME :** II B

**SECTION :** D

**REV. NO.** 02

**DATE :** 28.09.2007

**SHEET** 8 of 13

- 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 annexures, 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. 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.  
  
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.
- 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**



**TITLE:**  
**VERTICAL PUMPS**  
**STANDARD TECHNICAL SPECIFICATION**

**SPECIFICATION NO.** PES-179-07

**VOLUME :** II B

**SECTION :** D

**REV. NO.** 02 **DATE :** 28.09.2007

**SHEET** 9 of 13

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 the annexures.

**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 Annexures.

In case of external water/oil lubrication, complete lubrication arrangement shall be furnished with the pump. If the annexure calls for pre lubrication of the shaft bearings, pre lubrication tank and other accessories shall be within the scope of supply of Bidder/Contractor.

**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 of annexures or as per the recommendation of the pump manufacturer (and approved by Purchaser).

**9.08.00 Reverse Rotation**

**9.08.01** If the annexures call for, the pump impeller and other rotating components shall be designed for reverse rotation, when subject to reverse flow at rated pump discharge head.





**TITLE:**  
**VERTICAL PUMPS**  
**STANDARD TECHNICAL SPECIFICATION**

**SPECIFICATION NO.** PES-179-07

**VOLUME :** II B

**SECTION :** D

**REV. NO.** 02

**DATE :** 28.09.2007

**SHEET** 10 of 13

In addition ratchet shall be provided to prevent reverse rotation of the pump & motor as an additional feature.

**9.09.00 Drive Unit**

**9.09.01** The pump will be driven by electric motor as specified in annexures.

A heavy duty coupling shall be provided between the drive unit and the driven equipment.

**9.09.02** Unless otherwise specified in annexures, 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.

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

- a) Material identification and testing shall include, but shall not be limited to the following components :
  - i) Bowls and suction bells.
  - ii) Impeller and wearing rings.
  - iii) Shafts and shaft sleeves.
  - iv) Couplings.
  - v) Bearings.
  - vi) Column pipes.



**TITLE:**  
**VERTICAL PUMPS**  
**STANDARD TECHNICAL SPECIFICATION**

**SPECIFICATION NO.** PES-179-07

**VOLUME :** II B

**SECTION :** D

**REV. NO.** 02

**DATE :** 28.09.2007

**SHEET** 11 of 13

- vii) Discharge heads
- viii) Bowl Assembly
- b) Test shall also include but shall not be limited to the following :
  - i) The entire surface of the impeller/ casing / diffuser castings shall be subjected to Dye Penetration Test as per ASTM-E-165.
  - ii) Shaft, coupling & other active components shall be subject to dye penetration and ultrasonic test.
  - iii) Wearing rings, shaft sleeves shall be subjected to Dye Penetration Test.
  - iv) Fabricated components of pumps shall be subjected to Dye penetration test on weld.
  - v) Witnessing of NDT/review of NDT reports.
  - vi) Static balancing test for impeller and dynamic balancing of complete rotating parts as per ISO-1940 to grade 6.3 or better.
  - vii) Complete Inspection of assembled pump.
- c) Hydrostatic test shall be done for the following components (as minimum) at 2 times the bowl discharge pressure at rated capacity or 150% of the shut-off pressure. Pressure shall be maintained for a period of not less than one (1) hour. While arriving at the above values, maximum suction pressure shall be taken into account. During testing there should not be any pressure drop & leakage.
  - i) Bowls/ Suction bells
  - ii) Columns pipe
  - iii) Discharge head.
  - iv) Any other applicable pressure parts.
- d) **Performance Test at shop**
  - i) Each pump shall have to be tested to determine 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 the rated speed. These shall be carried out to span 130% of





**TITLE:**  
**VERTICAL PUMPS**  
**STANDARD TECHNICAL SPECIFICATION**

**SPECIFICATION NO.** PES-179-07

**VOLUME :** II B

**SECTION :** D

**REV. NO.** 02

**DATE :** 28.09.2007

**SHEET** 12 of 13

rated capacity upto pump shut-of 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 specified. 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) The Bidder shall submit in his proposal the facilities available at his works to conduct performance testing.
- v) NPSH tests are to be conducted on one pump of each type at 3% head drop conditions, if specified in the pump Annexures.
- vi) 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.
- vii) 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.

**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 Customer. The representative shall be available here till category I approval of all the drawings and documents.



**TITLE:**  
**VERTICAL PUMPS**  
**STANDARD TECHNICAL SPECIFICATION**

**SPECIFICATION NO.** PES-179-07

**VOLUME :** II B

**SECTION :** D

**REV. NO.** 02

**DATE :** 28.09.2007



**SHEET** 13 of 13

**14.00.00** Guarantee for all pumps shall at least remain valid for 18 months from the Unit commissioning date.

**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.
- 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) HT Motor data (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- 323/362 -165-N001	
	DRIP PUMPS		REV. NO.:00	10.08.2011
	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 max. speed of 1500 rpm (synchronous)		
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, cannister 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 2 at various operating conditions		
2.7	Design Capacity	270 CubM (refer sheet 2 of 2 for flow at various operating conditions)		
2.8	Design TDH (total dynamic head)	220 MLC (refer sheet 2 of 2 for head at various operating conditions)		
2.9	NPSHA at centre line of suction flange	2.0 MLC		
2.10	NPSHR	NPSH (R) at 3% head drop shall not be more than half the NPSH(A) at design flow.		
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	Cannister/ 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 of mesh size 245 		
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.			

Sheet 1 of 2

BHEL PEM	DATASHEET A				SPEC. NO: PE-TS-323/362-165-N001	
	DRIP PUMP PARAMETERS					
	PROJECT TITLE : 2X800 MW YERMARUS STPP				SHEET NO.: 2 OF 2	
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 <sup>3</sup> /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	

	DATA SHEET - B		SPECIFICATION NO.: PE-TS- 323/362 -165-N001	
	DRAIN PUMPS		REV. NO.:00	10.08.2011
	2X200 MW TISHREEN TPP, SYRIA		VOLUME : II B	SECTION : D
Sl. No.	Description	DRAIN 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	Motor with maximum speed of 1500 rpm		
1.6	Direct drive	Yes		
1.7	Drive included in pump supplier scope	Yes		
1.8	Motor designed for end of the curve operation with discharge valve open	Yes		
1.9	Suction strainers	Not applicable		
2.0	Pump Design			
2.1	Pump type	Vertical, cannister type, centrifugal, diffuser type		
2.2	Pump Design Code	HIS (latest edition)		
2.3	Sealing arrangement	As per manufacturer standard to prevent air ingress even when the pump is under shutdown		
2.4	Liquid handled	Condensate in saturated condition		
2.5	Specific gravity	0.985		
2.6	Design Capacity	280 CubM		
2.7	Design TDH (total dynamic head)	10 MLC		
2.8	Suction pressure	0.5 kg/cm <sup>2</sup> (a)		
2.9	Suction temperature	60 deg C		
2.1	NPSHA at centre line of suction flange	1 MLC		
2.11	NPSHR	NPSH (R) at 3% head drop shall not be more than half the NPSH(A) at design flow.		
2.12	Suction piping	273 x 6.35		
2.13	Discharge piping	219.1 x 6.35		
2.14	End connections	Discharge and suction connection of weld neck type, raised steel flange as per ANSI B 16.5.		
3.0	Material of Construction			
3.1	Cannister/ 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.		
4.0	Performance curve	Characteristic curve of pumps should be continuously rising type with decrease in flow and shut-off head shall preferably be between 115% to 130% of TDH of design point, however higher shut off head may be considered.		
5.0	Motor rating	Continuous Motor rating (at 50 deg.C ambient ) selected shall be maximum of following (i.e. Whichever is higher):  i) At least 10% margin over the max. power requirement at any condition of the entire characteristic curve of the pump ii) 15% margin over the power requirement at the design point.		
6.0	Permissible tolerance in rated capacity & TDH	No negative tolerance		
7.0	Type test	NPSH (R) test on one drain 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 2.5 lac per KW		
	Maximum permissible efficiency for Bid evaluation			
10.2	Pump Efficiency	72%		
10.3	Motor Efficiency	88%		
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 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.			



TECHNICAL SPECIFICATIONS  
SPECIAL PROCESS VERTICAL  
PUMPS  
DATA SHEET - C

SPECN. NO.:	PE-TS-323/362 -165-N001		
VOLUME:	IIB	SECTION:	D1
REV. NO.	0	DATE:	10.08.11

**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.

# STANDARD QUALITY PLAN

FOR

CENTRIFUGAL PUMPS (HORIZONTAL/VERTICAL)

Q.P. NO. : PEM/MSE/SQP/01 REV. 0



**BHARAT HEAVY ELECTRICALS LIMITED**  
**PROJECT ENGINEERING MANAGEMENT**  
**POWER SECTOR**  
**NEW DELHI**



**BHARAT HEAVY ELECTRICALS LIMITED**  
PROJECT ENGINEERING MANAGEMENT

**STANDARD QUALITY PLAN**

PROJECT:  
VENDOR :

SYSTEM:  
ITEM :

CENTRIFUGAL PUMPS ( HORIZONTAL/VERTICAL )

S /O	COMPONENT / OPERATION	CHARACTERISTICS CHECKED	QAT. EGRY	TYPE / METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY P W V	REMARKS
1	2	3	4	5	6	7	8	9	10	11
1.0	MATERIALS CONTROL									
1.1	CASING (INCLUDING BOWLS, DIFFUSERS, STAGE BODIES, DISCH HEAD (IF CAST), ETC. -AS APPLICABLE)	PHYSICAL AND CHEMICAL PROPS.	CR	PHYSICAL AND CHEM. ANALYSIS	ONE/HEAT/ BATCH	APPROVED DRG. / DATA SHEET	APPROVED DRG. / DATA SHEET	LAB. REPORT	3/2	
1.2	IMPELLERS	-DO-	CR	-DO-	-DO-	-DO-	-DO-	-DO-	3/2	
1.3	STUFFING BOX, SUCTION BELL, WEARING RINGS, NECK RINGS, SHAFT SLEEVES, GLAND	-DO-	MA	-DO-	-DO-	-DO-	-DO-	-DO-	3/2	2.1
1.4	STRESS RELIEVING/HEAT TREATMENT OF CASTING AS ABOVE (IF APPLICABLE)	HEAT CYCLE	MA	VERIFICA- TION OF SRHT	ALL BATCHES	U-DO-	-DO-	CORRELATED SR/H.T. CHARTS	3/2	2.1
1.5	BARS/FORGINGS FOR SHAFTS, LINE SHAFTS	1.PHYSICAL & CHEMICAL PROPS. 2.DIMENSIONS	CR	1.PHYSICAL CHEMICAL ANALYSIS 2.MEASUR- EMENT	1/CAST OR 1/BAR	-DO- MFR. DRAWING	-DO-	MILL T.C. OR LAB. REPORT	3/2	2.1
Q.P. NO.	PEN/MSE/SQP/01			PREPARED BY PEM	REVIEWED BY CQA	APPROVED BY PEM				ACCEPTED BY VENDOR
REV NO/DATE	00/18-10-97	NAME	ASHWINI KHANNA		K.C. JAIN	P. K. KHURANA			NAME	
PAGE NO	1 OF 6	SIGNATURE	Ashwin Khanna		Sd/-				SIGN	
		DATE	18-10-97		12-11-97	13-11-97			DATE	





**BHARAT HEAVY ELECTRICALS LIMITED**  
PROJECT ENGINEERING MANAGEMENT

PROJECT:  
VENDOR :

**STANDARD QUALITY PLAN**

SYSTEM :  
ITEM :

CENTRIFUGAL PUMPS (HORIZONTAL/VERTICAL)

S NO	COMPONENT / OPERATION	CHARACTERISTICS CHECKED	CAT- EGRY	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		
16	SHAFT ENCLOSING TUBES, COLUMN PIPES DISCHARGE ELBOW	3. INTERNAL DEFECTS FOR 50 MM & ABOVE DIA SHAFTS		3. ULTRA- SONIC TEST FOR >50MM	100%	ASTM A 388 BACK WALL ECHO 100%	DEFECT ECHO MAX 20% OF B.W.E. LOSS OF BACK WALL ECHO 20% MAX.	I.R.	3/2	2.1		
		1. PHYSICAL, CHEMICAL PROPS. 2. DIMENSIONS, 3. SURFACE FINISH	MA	1. PHYS. CHEM. TEST 2. MEAS. 3. VISUAL EXAM.	1/BATCH, 100% 100%	APPROVED DRG./ DATA SHEET	APPROVED DRG./ DATA SHEET	MFR. T.C. OR LAB. REPORT	3/2	2.1		
		1. PHYSICAL, CHEMICAL PROPS. 2. DIMENSIONS 3. SURFACE FINISH	MA	1. PHYS., CHEM. TEST 2. MEAS. 3. VISUAL EXAM.	1/CAST 100% 100%	APPROVED DRG./ DATA SHEET	APPROVED DRG./ DATA SHEET	MILL T.C.	3/2	2.1	CORRELATION REQUIRED FOR MAT OTHER THAN IS 2082	
18	SUCTION STRAINER (IF APPLICABLE)	1. PHYSICAL, CHEMICAL PROPS.	M	PHYS. CHEM. TESTS	1/HEAT	-DO-	-DO-	LAB. REPORT	3/2	2.1		
19	MECHANICAL SEAL (IF APPLICABLE)	1. TYPE, SIZE, MFRS. NO. MAKE	MA	VISUAL EXAM	100%	MFRS. DRG.	MFRS. DRG.		3/2	2.1	COMPLIANCE TO FOR APPROVED MAKE	
20	IN-PROCESS CONTROL											
21	ALL COMPONENTS UNDER 1.00 ABOVE	1. VISUAL DEFECTS, DIMENSIONS	MA	VISUAL EXAM MEASURE- MENT	100%	MFG. DRAWING	MFG. DRAWING NO HARMFUL DEFECT	-DO-	3/2			
Q/P NO		PEM/MSE/SQP/01		PREPARED BY PEM		REVIEWED BY CQA		APPROVED BY PEM		ACCEPTED BY VENDOR		
REV NO/DATE		NAME		ASHWINI KHANNA		K.C. JAIN		P. K. KHURANA		NAME		
		SIGNATURE		Ashwini Khanna		50/-		13-11-97		SIGN		
PAGE NO		DATE		18-10-97		12-11-97		13-11-97		WILL		



**BHARAT HEAVY ELECTRICALS LIMITED**  
PROJECT ENGINEERING MANAGEMENT

**STANDARD QUALITY PLAN**

PROJECT :  
VENDOR :

SYSTEM :

ITEM : CENTRIFUGAL PUMPS ( HORIZONTAL/VERTICAL )

S NO	COMPONENT / OPERATION	CHARACTERISTICS CHECKED	CAT- EGO- RY	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	
2.2	CASINGS/BOWLS, STAGE BODIES, DISCHARGE HEAD (IF CAST), SUCTION : HOUSING, COLUMN PIPE DISCHARGE PIPE ETC.	1. LEAK TIGHTNESS	CR	HYDRO TEST (DURATION 30 MIN. MINIMUM)	100%	TECHNICAL SPEC/ DATA SHEET	NO LEAKAGE	1.R & BHEL FORMAT	3/2	2.1		TEST PRESSURE SHALL BE: 2 X (DUTY POINT PR + POSIT) SUCTION HEAD) IF ANY OR, TIMES SHUT OFF HEAD + POSITIVE SUCTION HEAD (IF ANY) WHICHEVER IS HIGHER
2.3	FABRICATED COMPONENTS	CORRECTNESS	MA	EXAM.	100%	ASME SEC. IX	ASME SEC. IX	QW 482 OF ASME SEC. IX	3/2	2.1		
2.3.1	WELDING PROCEDURE SPECIFICATION											
2.3.2	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		WELDING PROCEDURE APPROVAL BY BHEL. ALT. 3RD PARTY (LLYODS, BVOI OR EQ) IS ACCEPTABLE
2.3.3	WELDER PERFORMANCE QUALIFICATION	WELD SOUNDNESS	MA	MEAS. VISUAL EXAM	100%	ASME SEC. IX	ASME SEC. IX	QW 484 OF ASME SEC. IX	3/2	2.1		
2.3.4	WELD FIT-UPS	1. DIMENSIONAL ALIGNMENT	MA	MEAS. VISUAL EXAM	100%	WPS, MFG. DRAWING	WPS, MFG. DRAWING	IR/LOG BOOK	3/2			
2.3.5	ROOT RUNS	1. SURFACE DEFECTS	MA	PENETRANT TEST	100%	ASTME 165	NO SURFACE DEFECT	-DO-	3/2	2		
2.3.6	WELDMENTS	1. SURFACE DEFECTS	MA	-DO-	100%	ASTME 165	ASME-VIII, DIV. I.	INSPN. REPORT	3/2	2.1		
Q.P. NO	PEM/MSE/SQP/01			PREPARED BY PEM		REVIEWED BY CQA	APPROVED BY PEM					ACCEPTED BY VENDOR
REV NO/DATE	00/18-10-97	NAME	ASHWINI KHANNA			K.C. JAIN	P. K. KHURANA				NAME	
		SIGNATURE	Ashwini Khanna			SD/-					SIGN	
PAGE NO	3 OF 6	DATE		18-10-97		12-11-97	13-11-97				DATE	



**BHARAT HEAVY ELECTRICALS LIMITED**  
PROJECT ENGINEERING MANAGEMENT

**STANDARD QUALITY PLAN**

PROJECT  
VENDOR :

SYSTEM :

ITEM : CENTRIFUGAL PUMPS ( HORIZONTAL/VERTICAL,

S. NO	COMPONENT / OPERATION	CHARACTERISTICS CHECKED	CAT. EGO-RY	TYPE / METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY P W V	REMARKS
1	2	3	4	5	6	7	8	9	10	11
2.3.7	BUTT WELDS	INTERNAL DEFECT	MA	UT/RT	100%			IR	3/2	2.1
2.3.8	DISCHARGE HEAD, COLUMN PIPE, DISCHARGE PIPE, ETC.	1. LEAK TIGHTNESS, DIMENSION	CR	HYDRO TEST MEASURE- MENT	100%	TECHNICAL SPEC./ DATA SHEET, MFR. DRAWING	NO LEAKAGE MFR. DRAWING	-DO-	3/2	2
2.4	IMPELLERS - ALL ACCESSIBLE SURFACES, DIFFUSERS (EXCEPT CI)	1. SURFACE DEFECTS	CR	PENETRANT TEST	100%	ASTME. 165	NO SURFACE DEFECTS	-DO-	3/2	2.1
2.5	IMPELLERS	1. STATIC, DYNAMIC, RESIDUAL UNBALANCE	CR	STATIC, DYNAMIC BALANCING	100%	ISO 1940	ISO 1940 G 6.3	INSPN. REPORT	3/2	3.1
2.6	SHAFTS	1. SURFACE DEFECTS	MA	PENETRANT TEST	100%	ASTME 165	NO SURFACE DEFECT	-DO-	3/2	2.1
3.0	SUB-ASSEMBLY CONTROL									
3.1	ROTOR ASSEMBLY	1. ECCENTRICITY	MA	MEASURE- MENT	100%	MFR. DRAWING	MFR. DRAWING	IR/LOG BOOK	3/2	
3.2	ROTOR ASSEMBLY RESIDUAL UNBALANCE	1. STATIC, DYNAMIC,	CR	STATIC, DYNAMIC BALANCING	100%	ISO 1940	ISO 1940 G 6.3	INSPN. REPORT	3/2	2.1
3.3	COMPLETE PUMP ASSEMBLY	1. COMPLETENESS, CORRECTNESS, CLEANLINES, FREELINESS, ALIGNMENT	MA	VISUAL EXAM MEASURE- MENT	100%	APPROVED DRG/ & MFG STANDARDS	APPROVED DRG/ & MFG STANDARDS	I.R./CHECK LISTS	3/2	2.1
Q.P.N.O		PEM/MSE/SQP/01	PREPARED BY PEM		REVIEWED BY CQA	APPROVED BY PEM	ACCEPTED BY VENDOR			
REV NO/DATE		00/18-10-97	ASHWINI KHANNA		K.C. JAIN	P. K. KHURANA	NAME			
PAGE NO.		4 OF 6	Ashwini Khanna		S.D/-		SIGN.			
			18-10-97		12-11-97	13-11-97	DATE			



**BHARAT HEAVY ELECTRICALS LIMITED**  
PROJECT ENGINEERING MANAGEMENT

**STANDARD QUALITY PLAN**

PROJECT :  
VENDOR :

SYSTEM :

ITEM : CENTRIFUGAL PUMPS (HORIZONTAL/VERTICAL)

S. NO.	COMPONENT / OPERATION	CHARACTERISTICS CHECKED	CAT. EGO. RY	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		
1.0	FINAL INSPECTION, TESTS & PACKING DESPATCH CONTROL											
4.1	PUMP WITH JOB MOTOR Assembled on individual base frame	1.Q/VIS HEAD, Q/VIS POWER, Q/VIS PUMP EFFICIENCY, VIBRATION, NOISE, BEARING TEMPERATURES RISE, LEAKAGES 2.NPSH REFER QUALITY PLAN FOR MOTORS	CR	PERFORMANCE TEST	100%	TECHNICAL SPEC./ APPD. DATA SHEET/ APPROVED CURVES	TECHNICAL SPEC./ DATA SHEET 'A' NO LEAKAGE	IR, PERF. TEST RECORD, PLOTTED CURVES	3/2	2,1	MINIMUM 7 POINTS FROM SHUT-OFF TO MINUS 25% T COVERING PUMP OPERATING RANGE, AS PER DATA SHEET SHALL BE TAKEN CUSTOMER HOLD FOR	
4.2	MOTOR		CR	PERFORMANCE TEST	I/TYPE	TECHNICAL SPEC./ APPD. DATA SHEET APPROVED CURVES, IS-3120	TECHNICAL SPEC./ DATA SHEET 'A' NO LEAKAGE	IR, PERF. TEST RECORD, PLOTTED CURVES	3/2	2,1	IF SPECIFIED	
4.3	STRIP DOWN AFTER PERFORMANCE TEST	1. UNDUE WEAR, TEAR AND BREAKAGE	CR	VISUAL EXAM AFTER STRIPPING	1/LOT/ SIZE	TECHNICAL SPEC.	NO UNDUE WEAR, TEAR & BREAKAGE	INSP. REPORT	3/2	1	Witness kept only when abnormal sound observed during performance test.	
4.4	COMPLETE PUMP WITH UNIT MOTOR BASE FRAME, COUNTERFLANGES ETC. INCLUDING ALL ACCESSORIES AS PER SECTION C OF SPECN.	COMPLETENESS, OVERALL CLEANLINESS, ORIENTATION, WORKMANSHIP AND FINISH	MA	VISUAL EXAM MEASUREMENT	100%	APPD. G.A. DRAWING	APPD. G.A. DRAWING	-DO-	3/2	1		
Q.P. NO.	PEM/MSE/SQP/01	PREPARED BY PEM				REVIEWED BY CQA	APPROVED BY PEM	ACCEPTED BY VENDOR				
REV. NO/DATE	00/18-10-97	NAME	ASHWINI KHANNA	K.C. JAIN		P. K. KHURANA		NAME				
		SIGNATURE	Ashwini Khanna	SD/-		Signature		SIGN				
PAGE NO.	5 OF 6	DATE	18-10-97	12-11-97		13-11-97		DATE				



**BHARAT HEAVY ELECTRICALS LIMITED**  
PROJECT ENGINEERING MANAGEMENT

**STANDARD QUALITY PLAN**

PROJECT :  
VENDOR :

SYSTEM :  
ITEM :

CENTRIFUGAL PUMPS ( HORIZONTAL/VERTICAL

S. NO.	COMPONENT / OPERATION	CHARACTERISTICS CHECKED	CAT. EGO. RY	TYPE / METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY P W V	REMARKS
1	2	3	4	5	6	7	8	9	10	11
4.5	COMPLETION OF ALL STAGES	1.COMPLETION	MA	VERIFICATION OF IR/ T.C. ETC.	100%	APPD. MFG. DRG./ TECHNICAL SPEC.	APPD. MFG. DRG./ TECHNICAL SPEC.	I.R.	3/2 2.1	
4.6	PAINTING	1.SURFACE FINISH, DFT, MARKINGS ETC.	M	VISUAL EXAM. MEASURE- MENT AESTHETIC	100%	APPD. DRG./SPEC.	APPD. DRG./SPEC.	I.R.	3/2 2.	
4.7	PACKING, MARKING	SOUNDNESS OF PACKING		VISUAL AESTHETIC	100%	MFG. STANDARD	MFG. STANDARD		3/2 2.	

Legend : 1- BHEL/CUSTOMER , 2- Vendor , 3 -Sub vendor  
P- Perform , W - Witness , V - verification

Q.P.C	PEMM/SE/SQP/01	APPROVED BY PEM	REVIEWED BY CQA	ACCEPTED BY VENDOR
REV'D/DATE	00/18-10-97	NAME ASHWINI KHANNA	K.C. JAIN	NAME
PAGE NO	6 OF 6	SIGNATURE Ashwini Khanna	Sd/-	SIGN.
		DATE 18-10-97	12-11-97	DATE 13-11-97



TECHNICAL SPECIFICATIONS  
SPECIAL PROCESS VERTICAL  
PUMP

SPECN. NO.:

PE-TS-323/362 -165-N001

VOLUME:

IIB

SECTION:

D2

REV. NO.

0

DATE:

10.08.11

**SECTION D2**

**STANDARD MOTOR SPECIFICATION**

**STANDARD QUALTY PLAN FOR MOTORS**

- Motors below 75KW
- Motors 75 KW & above (LV & MV)



TITLE :  
**GENERAL TECHNICAL REQUIREMENTS**  
  
**FOR**  
  
**LV MOTORS**

SPECIFICATION NO.  
**PE-SS-999-506-E101**


VOLUME NO. :	<b>II-B</b>
SECTION :	<b>D</b>
REV NO. : 00	DATE : 29/08/2005
SHEET :	<b>1 OF 1</b>

**GENERAL TECHNICAL REQUIREMENTS**

**FOR**

**LV MOTORS**

**SPECIFICATION NO.: PE-SS-999-506-E101 Rev 00**

	TITLE : <b>GENERAL TECHNICAL REQUIREMENTS</b>  <b>FOR</b>  <b>LV MOTORS</b>	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 29/08/2005
		SHEET : 1 OF 4

1.0 INTENT OF SPECIFICATION

The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer's work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station.

Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.

2.0 CODES AND STANDARDS

Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards:

IS:325	Three phase Induction motors
IS : 900	Code of practice for installation and maintenance of induction motors
IS: 996	Single phase small AC and universal motors
IS: 4722	Rotating Electrical machines
IS: 4691	Degree of Protection provided by enclosures for rotating electrical machines
IS: 4728	Terminal marking and direction of rotation rotating electrical machines
IS: 1231	Dimensions of three phase foot mounted induction motors
IS: 8789	Values of performance characteristics for three phase induction motors
IS: 13555	Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment
IS: 2148	Flame proof enclosures for electrical appliance
IS: 5571	Guide for selection of electrical equipment for hazardous areas
IS: 12824	Type of duty and classes of rating assigned
IS: 12802	Temperature rise measurement for rotating electrical machines
IS: 12065	Permissible limits of noise level for rotating electrical machines
IS: 12075	Mechanical vibration of rotating electrical machines

In case of imported motors, motors as per IEC-34 shall also be acceptable.

3.0 DESIGN REQUIREMENTS

3.1 Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A

3.2 Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information  
Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above.

3.3 Starting Requirements

3.3.1 Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

3.3.2 Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.





**TITLE :**  
**GENERAL TECHNICAL REQUIREMENTS**  
**FOR**  
**LV MOTORS**

**SPECIFICATION NO.**  
PE-SS-999-506-E101  
**VOLUME NO. :** II-B  
**SECTION :** D  
**REV NO. :** 00 **DATE :** 29/08/2005  
**SHEET :** 2 OF 4

The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.

**3.3.3 The following frequency of starts shall apply**

- i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.
- ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour)
- iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor

**3.4 Running Requirements**

**3.4.1** Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.

**3.4.2** Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.

**3.5 Stress During bus Transfer**

**3.5.1** Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.

**3.5.2** Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.

**3.6** Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.

**3.7** The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.


**4.0 CONSTRUCTIONAL FEATURES**


**4.1** Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy

**4.2** Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.

Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled

**4.3** Motors shall be designed with cooling fans suitable for both directions of rotation.

	<b>TITLE :</b> <b>GENERAL TECHNICAL REQUIREMENTS</b>  <b>FOR</b>  <b>LV MOTORS</b>	<b>SPECIFICATION NO.</b> <b>PE-SS-999-506-E101</b>
		<b>VOLUME NO. : II-B</b>
		<b>SECTION : D</b>
		<b>REV NO. : 00 DATE : 29/08/2005</b>
		<b>SHEET : 3 OF 4</b>
<p>4.4.</p> <p>4.5.</p> <p>4.6.</p> <p>4.7</p> <p>4.7.1</p> <p>4.7.2</p> <p>4.7.3</p> <p>4.7.4</p> <p>4.7.5</p> <p>4.7.6</p> <p>4.7.7</p> <p>4.7.8.</p> <p>4.7.9</p> <p>4.8</p> <p>4.9</p>	<p>Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.</p> <p>Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.</p> <p>In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation. In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.</p> <p><b>Terminals and Terminal Boxes</b></p> <p>Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A.</p> <p>Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".</p> <p>unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.</p> <p>Connections shall be such that when the supply leads R, Y &amp; B are connected to motor terminals A B &amp; C or U, V &amp; W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W &amp; V respectively.</p> <p>Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.</p> <p>Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.</p> <p>Degree of protection for terminal boxes shall be IP 55 as per IS 4691.</p> <p>Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.</p> <p>Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.</p> <p>Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.</p> <p>Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.</p> <p><b>General</b></p>	

	<b>TITLE :</b> <b>GENERAL TECHNICAL REQUIREMENTS</b>  <b>FOR</b>  <b>LV MOTORS</b>	<b>SPECIFICATION NO.</b> PE-SS-999-506-E101
		<b>VOLUME NO. :</b> II-B
		<b>SECTION :</b> D
		<b>REV NO. : 00</b> <b>DATE : 29/08/2005</b> <b>SHEET : 4 OF 4</b>

4.9.1 Motors provided for similar drives shall be interchangeable.

4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.

4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.

4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.

4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.

4.9.6 Name plate with all particulars as per IS: 325 shall be provided

4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.

**5.0 INSPECTION AND TESTING**

5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.

5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.

5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.

5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.

**6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT**

a) OGA drawing showing the position of terminal boxes, earthing connections etc.

b) Arrangement drawing of terminal boxes.


c) Characteristic curves:  
*(To be given for motor above 55 kW unless otherwise specified in Data Sheet).*

i) Current vs. time at rated voltage and minimum starting voltage.

ii) Speed vs. time at rated voltage and minimum starting voltage.


iii) Torque vs. speed at rated voltage and minimum voltage.  
 For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.

iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.

	<b>TITLE</b>  <b>MOTOR</b>  <b>DATA SHEET - C</b>	<b>SPECIFICATION NO.</b>	
		<b>VOLUME</b>	<b>II B</b>
		<b>SECTION D</b>	
		<b>REV NO. 00 DATE 29/08/2005</b>	
		<b>SHEET</b>	<b>1 OF 2</b>

S. No.	Description	Data to be filled by successful bidder
<b>A.</b>	<b>General</b>	
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>B.</b>	<b>Design and Performance Data</b>	
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	


<b>NAME OF VENDOR</b>			<b>SEAL</b>	<b>REV.</b>	
<b>NAME</b>	<b>SIGNATURE</b>	<b>DATE</b>			

	<b>TITLE</b>  <b>MOTOR</b> <b>DATA SHEET - C</b>	<b>SPECIFICATION NO.</b>
		<b>VOLUME</b> II B
		<b>SECTION D</b>
		<b>REV NO. 00 DATE 29/08/2005</b>
		<b>SHEET 2 OF 2</b>

S. No.	Description	Data to be filled by successful bidder
	c) At starting	
<b>C.</b>	<b>Constructional Features</b>	
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)	
<b>D.</b>	<b>Characteristic curves/ drawings</b> (To be enclosed for motors of rating $\geq 55KW$ )	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

<b>NAME OF VENDOR</b>			<b>SEAL</b>	<b>REV.</b>	
<b>NAME</b>	<b>SIGNATURE</b>	<b>DATE</b>			


CUSTOMER :		PROJECT		SPECIFICATION :							
BIDDER/		TITLE		NUMBER :							
VENDOR		QUALITY PLAN		SPECIFICATION							
SYSTEM		NUMBER PED-506-00-Q-006/0		TITLE							
CAT.		ITEM AC ELECT. MOTORS BELOW 75KW (LV)		VOLUME III							
TYPE/		REFERENCE		SECTION							
METHOD OF		DOCUMENT		AGENCY							
CHECK		NORM		P W V							
EXTENT OF		FORMAT		REMARKS							
CHECK		OF RECORD									
3		8		10							
4		9		11							
1	2	3	4	5	6	7	8	9	10	11	
1.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUF'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	3	-	
2.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	3	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	3	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	3	-	
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	3	2,1 2,1	NOTE -1
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	
BHEL		PARTICULARS		BIDDER/VENDOR							
		NAME									
		SIGNATURE									
		DATE									
						BIDDER'S/VENDORS COMPANY SEAL					

		QUALITY PLAN		CUSTOMER :		PROJECT TITLE		SPECIFICATION : NUMBER :	
				BIDDER/ VENDOR		QUALITY PLAN		SPECIFICATION : TITLE :	
COMPONENT/OPERATION		SHEET 2 OF 2		SYSTEM		ITEM AC ELECT. MOTORS BELOW 75KW (LV)		VOLUME III	
SL. NO.	CHARACTERISTICS CHECK	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION AGENCY	REMARKS	
1	2	3	4	5	6	7	8	9	10
	3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	3	1
<p>NOTES:</p> <p>1 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</p> <p>2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.</p> <p>3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW, ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.</p>									
BHEL		PARTICULARS		BIDDER/VENDOR					
		NAME							
		SIGNATURE							
		DATE							
						BIDDER'S/VENDORS COMPANY SEAL			


CUSTOMER :		PROJECT TITLE		SPECIFICATION : NUMBER :						
BIDDER/ VENDOR		QUALITY PLAN		SPECIFICATION : TITLE						
SYSTEM CAT.		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)		VOLUME III						
CHARACTERISTIC CHECK		ACCEPTANCE NORM		REMARKS						
TYPE/ METHOD OF CHECK		EXTENT OF CHECK		SECTION AGENCY						
CAT.		6		P W V						
3		4		5						
2		7		8						
1		9		10						
11										
1.0	RAW MATERIAL & BROUGHT 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-	INSPEC. REPORT		3	-
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM CRACKS, UNEVENNESS ETC.	-DO-	3	-
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVANT 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.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVANT IS/	SUPPLIERS TC	3	2
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUF'R'S DRG.	MANUF'R'S DRG.	LOG BOOK	3	-
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	-
BHEL		PARTICULARS		BIDDER/VENDOR						
NAME		SIGNATURE		DATE						
BIDDER'S/VENDOR'S COMPANY SEAL										




BHEL		QUALITY PLAN		CUSTOMER :		PROJECT		SPECIFICATION :				
SHEET 2 OF 9		BIDDER/ VENDOR		TITLE		NUMBER :		SPECIFICATION :				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	VOLUME III			
1	2	3	4	5	6	7	8	9	10			
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-	MANUF'R'S DRG.	LOG BOOK	3	-	-	
		4. INTERNAL FLOWS	CR	UT	-DO-	ASTM-A388	MANUF'R'S SPEC. BHEL SPEC.	-DO-	3	2	1	FOR DIA OF 55 MM & ABOVE
1.6	SPACE HEATERS, CONNECTORS, TERMINAL BLOCKS, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUF'R'S DRG. SPEC.	MANUF'R'S DRG. SPEC.	-DO-	3	-	-	
		2. PHYSICAL COND.	MA	-DO-	-DO-	-	NO BREAKAGE ON OTHER PHY. DESIGN	-DO-	3	-	-	
		3. DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUF'R'S DRG. / SPEC.	MANUF'R'S DRG. / SPEC.	-DO-	3	-	-	
		4. PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	-	
BHEL										BIDDER/VENDOR		
PARTICULARS												
NAME												
SIGNATURE												
DATE												
										BIDDER/SVENDORS COMPANY SEAL		

		QUALITY PLAN		CUSTOMER :		PROJECT		SPECIFICATION :							
SHEET 3 OF 9		BIDDER/ VENDOR SYSTEM		TITLE		QUALITY PLAN		NUMBER :							
COMPONENT/OPERATION		CAT.		EXTENT OF CHECK		REFERENCE DOCUMENT		ACCEPTANCE NORM		FORMAT OF RECORD		SECTION		VOLUME III	
SL. NO.	CHARACTERISTIC CHECK	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION	AGENCY	P	W	V	REMARKS			
1	2	3	4	5	6	7	8	9	10	11					
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND.	MA	VISUAL	100%	-	NO VISUAL DEFECTS	INSPT. REPORT	3	-	-				
		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	MANUF'S DRG.	MANUF'S DRG.	-DO-	3	-	2	FOR MV MOTOR INSULATION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT			
		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. 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	-	2				
BHEL		PARTICULARS		BIDDER/VENDOR											
		NAME													
		SIGNATURE													
		DATE													
													BIDDER'S/VENDORS COMPANY SEAL		


CUSTOMER :		PROJECT		SPECIFICATION :						
BIDDER/ VENDOR		TITLE		NUMBER :						
SYSTEM		QUALITY PLAN		SPECIFICATION :						
CAT.		NUMBER PED-506-00-Q-007/2		TITLE						
SHEET 4 OF 9		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)		VOLUME III						
CHARACTERISTIC CHECK		REFERENCE DOCUMENT		REMARKS						
EXTENT OF CHECK		ACCEPTANCE NORM		SECTION						
METHOD OF CHECK		FORMAT OF RECORD		AGENCY						
TYPE/		P		W						
METHOD OF CHECK		V		V						
1	2	3	4	5	6	7	8	9	10	11
1.10	BEARINGS	3.DIMENSIONS	MA	MEASUREMENT	-DO-	MANFR'S DRG.	-DO-	Log Book	3	-
		1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG.	-DO-	-DO-	3	-
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	-DO-	-DO-	3	-
		3.SURFACE FINISH	MA	VISUAL	100%	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	-DO-	3	-
1.11	SLIP RING	1.SURFACE COND.	MA	VISUAL	100%	-DO-	-DO-	-DO-	3	-
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	-DO-	-DO-	3	-
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	-DO-	MANUF'S SPEC.	-DO-	-DO-	3	-
		4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	MANUF'S DRG/SPECS	-DO-	-DO-	3	-
		2.SURFACE COND.	MA	VISUAL	100%	-	-DO-	-DO-	3	-
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	-DO-	-DO-	3	-
BHEL										
PARTICULARS										
NAME										
SIGNATURE										
DATE										
BIDDER'S/VENDORS COMPANY SEAL										

		QUALITY PLAN		CUSTOMER :		PROJECT		SPECIFICATION :		
SHEET 5 OF 9		BIDDER/ VENDOR :		TITLE		NUMBER :		TITLE		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	SYSTEM CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	VOLUME III REMARKS	
1	2	3	4	5	6	7	8	9	10	
									P W V	
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.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	3	-
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3	-
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	3	-
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVANT SPEC./ ASTM-E165	MANUF'S SPEC./ BHEL SPEC./	-DO-	3	1
2.3	PAINING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANUF'S SPEC./ BHEL SPEC./ RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	3	-
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	3	2
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	3	-
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	3	-
BHEL										
PARTICULARS										
NAME										
SIGNATURE										
DATE										
BIDDER'S/VENDORS COMPANY SEAL										



		CUSTOMER :		PROJECT		SPECIFICATION :	
		BIDDER/ VENDOR		TITLE		NUMBER :	
QUALITY PLAN		BIDDER/ VENDOR		QUALITY PLAN		SPECIFICATION :	
SHEET 7 OF 9		SYSTEM		NUMBER PED-508-00-Q-007/2		TITLE	
COMPONENT/OPERATION		CAT.		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)		SECTION	
CHARACTERISTIC CHECK		TYPE/ METHOD OF CHECK		REFERENCE DOCUMENT		AGENCY	
EXTENT OF CHECK		FORMAT OF RECORD		P		REMARKS	
3		4		5		6	
2		3		2		1	
1		2		1		1	
2.7		COMPLETE STATOR ASSEMBLY		4.DURATION		10	
2.8		BRAZING/COMPRESSION JOINT		1.COMPACTNESS & CLEANLINESS		11	
2.9		COMPLETE ROTOR ASSEMBLY		1.COMPLETENESS			
2.10		ASSEMBLY		2.SOUNDNESS			
				3.HV			
				1.RESIDUAL UNBALANCE			
				2.SOUNDNESS OF DIE CASTING			
				1.ALIGNMENT			
				2.WORKMANSHIP			
				3.AXIAL PLAY			
				4.DIMENSIONS			
				5.CORRECTNESS, COMPLETENESS, TERMINATIONS/ MARKING/ COLOUR CODE			
BHEL		PARTICULARS		BIDDER/VENDOR		BIDDER'S/VENDORS COMPANY SEAL	
		NAME					
		SIGNATURE					
		DATE					

BHEL		CUSTOMER :		PROJECT TITLE		SPECIFICATION : NUMBER :	
QUALITY PLAN		BIDDER/ VENDOR :		QUALITY PLAN		SPECIFICATION : TITLE	
SHEET 8 OF 9		SYSTEM CAT.		ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD
1	2	3	4	5	6	7	8
3.0	TESTS	1. TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC.	MA	ELECT. TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT
		2. ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-
		3. VIBRATION	MA	-DO-	100%	IS-12075	-DO-
		4. OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	INSPC. REPORT
		5. DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	TC
		6. NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	INSPC. REPORT
		7. EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	TC
		8. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	TC
BHEL		PARTICULARS		BIDDER/VENDOR		SECTION AGENCY	
		NAME					P W V
		SIGNATURE					
		DATE					
		BIDDER/SVENDORS COMPANY SEAL					

		QUALITY PLAN		CUSTOMER :		PROJECT TITLE		SPECIFICATION : NUMBER :		
		SHEET 9 OF 9		BIDDER/ VENDOR		QUALITY PLAN		SPECIFICATION : TITLE		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	SYSTEM CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION AGENCY	VOLUME III REMARKS
1	2	3	4	5	6	7	8	9	10	11
<p>NOTES:</p> <p>1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED.</p> <p>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.</p> <p>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.</p> <p>4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION WITH THE CUSTOMERS, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.</p>										
<p>BHEL</p>										
PARTICULARS			BIDDER/VENDOR							
NAME										
SIGNATURE										
DATE										
BIDDER'S/VENDORS COMPANY SEAL										