

RAJASTHAN RAJYA VIDYUT UTPADAN NIGAM LIMITED (RRUVNL)

2 X 660 MW SURATGARH STPS UNIT 7 & 8


VOLUME -IIB


**TECHNICAL SPECIFICATION
FOR
MISCELLANEOUS PUMPS**


Specification No. : PE-TS-392-100-N002 (REV. 0)



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


	PREAMBLE		SPECIFICATION NO.:		PE-TS-392-100-N002	
			REV. NO.	0	DATE:	20.11.13
<p>1.0 The tender document contains three (3) volumes. The bidder shall meet the requirements of all the three volumes.</p> <p>1.1 Volume I - CONDITIONS OF CONTRACT</p> <p>This consists of four parts as below:</p> <p>Volume - I A : This part contains instructions to bidders for making bids to BHEL.</p> <p>Volume - I B : This part contains general commercial conditions of the tender and include provision that vendor shall be responsible for the quality of item supplied by their sub-vendors.</p> <p>Volume - I C : This part contains special conditions of contract.</p> <p>Volume - I D : This part contains commercial conditions for erection and commissioning site work, as applicable.</p> <p>1.2 Volume II - TECHNICAL SPECIFICATIONS</p> <p>Technical requirements are stipulated in Volume II which comprises of:</p> <p>Volume - II A : General Technical Conditions</p> <p>Volume - II B : Technical specification including drawings, if any</p> <p>1.2.1 Volume - II B :</p> <p>This volume is sub-divided into following sections:</p> <p>Section - A : This section outlines the scope of enquiry.</p> <p>Section - B : This section provides "Project Information"</p> <p>Section - C : This section indicates technical requirements specific to the contract, not covered in Section-D.</p> <p>Section - D : This section comprises of technical specifications of equipments complete with data sheet A, B & C.</p> <p>Data sheet - A specifies data and other requirements pertaining to the equipment.</p> <p>Data sheet - B specifies data to be filled by the bidder (Data Sheet B is contained in Volume - III)</p> <p>Data sheet - C indicates data documents to be furnished after the award of contract as per agreed schedule by the vendor (as applicable).</p> <p>1.2.2 Volume - III TECHNICAL SCHEDULES</p> <p>This volume contains technical schedules and Data Sheets - B, which are to be duly filled by the bidder and the same shall be furnished with the technical bid as per checklist, sec B7 in vol III.</p> <p>2.0 The requirements mentioned in Section C/Data Sheets-A of Section-D shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section - D.</p>						

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	MISCELLANEOUS PUMPS	REV. NO.	0	DATE:	20.11.13
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SECTION A

SCOPE OF INQUIRY

	TECHNICAL SPECIFICATIONS	SPECIFICATION NO.:		PE-TS-392-100-N002	
	MISCELLANEOUS PUMPS SCOPE OF ENQUIRY	VOLUME:	IIB	SECTION:	A
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1.0 SCOPE

1.1 This enquiry covers the design, manufacture, assembly, inspection and testing at manufacturer's and/or his sub-contractors works, proper packing for delivery and installation checks and replacement of gland packing with Mechanical Seal arrangement (if applicable) at site for Miscellaneous Pumps along with mandatory spares complete with all accessories as per the requirements specified in this specification for following project.

2 X 660 MW SURATGARH STPS UNIT 7 & 8

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

1.2 The miscellaneous pumps covered under this specification shall be Horizontal & Vertical pumps.

NOTE:-

a) **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 bidder's offer for that Project/Group.**

1.3 The pumps erected by the purchaser shall be cheked by the bidder for correctness of their installation, alignment, etc. at site prior to their commissioning. Replacement of gland packing with Mechanical Seal (If applicable) as per Cl. No. 2.0 of Section C1 of this volume. The charges for these shall be included by bidder in his base price, itself.

1.4 The miscellaneous 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 Horizontal Centrifugal pumps/ Vertical pumps specified under 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 I of section C-2 of this volume.

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.

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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.

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Annexure I

List of Miscellaneous Pumps and drives for :

2 X 660 MW SURATGARH STPS UNIT 7 & 8

Sl. No.	Pump Description	Total Qty.	Type of Pumps
Horizontal Pumps (Group I)			
1	DMCW TG Aux's Pumps	6 nos.	Horizontal
2	DMCW SG Aux's Pumps	4 nos.	Horizontal
3	APH/ESP Wash Pumps	2 nos.	Horizontal
4	CHP Make up Pumps	2 nos.	Horizontal
5	AHP Make up Pumps	3 nos.	Horizontal
6	DM Make up Pumps	2 nos.	Horizontal
7	Hotwell Make up Pumps	4 nos.	Horizontal
8	Boiler Fill Pumps	2 nos.	Horizontal

Sl. No.	Pump Description	Total Qty.	Type of Pumps
Vertical Pumps (Group II)			
1	ACW Pumps	5 nos.	Vertical
2	River/ Raw Water intake Pumps	5 nos.	Vertical
3	Raw Water Pumps	3 nos.	Vertical
4	Ash water make up Pumps	3 nos.	Vertical
5	Plant Potable/ Filtered Water Pumps	2 nos.	Vertical
6	AHP Seal Water Pumps	2 nos.	Vertical
7	CW Make up Pumps	3 nos.	Vertical
8	Plant Service water Pumps	2 nos.	Vertical

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Annexure II


Following HT drives for 2 X 660 MW SURATGARH STPS UNIT 3 & 4, irrespective of Motor ratings shall be issue free, by BHEL:

Horizontal Pumps (Group I)

- 1 DMCW TG Aux's Pumps
- 2 DMCW SG Aux's Pumps
- 3 APH/ESP Wash Pumps


Vertical Pumps (Group II)

- 1 ACW Pumps
- 2 River/ Raw Water intake Pumps
- 3 Raw Water Pumps

	TECHNICAL SPECIFICATIONS MISCELLANEOUS PUMPS	SPECIFICATION NO.: PE-TS-392-100-N002		
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SECTION B

PROJECT INFORMATION

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	MISCELLANEOUS PUMPS	VOLUME:	IIB	SECTION:	B1
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<div>SECTION B1</div> <div>PROJECT INFORMATION</div> <div>RRUVNLL - 2 x 660 MW SURATGARH STPS UNIT 7 & 8</div>					

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED		VOLUME II SECTION – B
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan GENERAL PROJECT INFORMATION		SHEET 1 OF 3

1.0	Owner	Rajasthan Rajya Vidyut Utpadan Nigam Ltd., Jaipur
2.0	Consulting Engineer	TATA Consulting Engineers Ltd. 73/1, St. Marks Road, Bangalore – 560 001 Tel : 080 – 6622 6000 Fax : 080 – 22274874
3.0	Location of the plant	Prabat Nagar, Suratgarh Sriganganagar district, Rajasthan.
4.0	Latitude and longitude	Latitude : 29 deg. 10 min. N Longitude : 74 deg.01 min. E
5.0	Elevation above mean sea level	186 m (approximate)
6.0	Climatic conditions	
6.1	Temperatures : Monthly basis	
	Mean of daily max.	32.8 deg.C (in the month of May)
	Mean of daily min.	17.6 deg.C (in the month of Jan)
6.2	Temperatures : Annual basis	
	Mean of daily max.	32.3 deg.C
	Mean of daily min.	19.6 deg.C
	Highest temperature recorded	50 deg.C
	Lowest temperature recorded	(-) 2.8 deg.C
	Design Ambient Temperature for Electrical Equipment design	50 deg C
6.3	Relative humidity	Varies between 21% and 81%
6.4	Annual average rain fall	312 mm
6.5	Annual mean wind speed :	4 km / hr.
7.0	Wind load	

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SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED		VOLUME II SECTION – B
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan GENERAL PROJECT INFORMATION		SHEET 2 OF 3

	Calculations for wind effect shall be in accordance with IS:875-1987(Part-3) taking into account the following:	
	a) Basic wind speed = 47 m/sec	
	b) Factor K1 = 1.07	
	c) Category of terrain = Category 2	
	d) K3 – as per IS 875	
8.0	Seismic data (As per IS: 1893 latest issue)	
	a) Zone	Zone II
	Designs & design coefficients shall be based on IS 1893:2002	
	Design condenser cooling water inlet temperature	33 Deg C
9.0	Auxiliary power supply:	
	Auxiliary electrical equipment to be supplied against this specification shall be suitable for operation on the following system:	
	a) For motors rated 160 kW and below.	415V AC, 3-phase, 3-wire effectively earthed.
	b) For motors rated above 160 kW and up to 1500 kW	6600V AC, 3-phase, 3-wire, 50 Hz, non-effectively earthed
	c) For motors rated above 1500kW	11000V AC, 3-phase, 3-wire, 50 Hz, non-effectively earthed
	d) For motor control centres	415V AC, 3-phase, 3/4-wire effectively earthed.
	e) DC motor starters, DC solenoids, DC alarm control and protection	220 V DC, 2-wire unearthed
	f) AC control & protective devices	110 V 1 phase, 50Hz, 2 wire AC supply. The single phase 110V AC supply shall be derived by VENDOR by providing 415V / 110 V Control transformers of adequate rating with MCCB / MCB on both the primary and secondary sides.
	g) Uninterrupted power supply	230 V, 1-phase, 50 Hz, 2-wire, AC

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SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED		VOLUME II SECTION – B
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan GENERAL PROJECT INFORMATION		SHEET 3 OF 3

		supply (For all instrumentation and control system equipment and solenoid valves)
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g) Lighting fixtures and space heaters 240 V, 1 phase, 2 wire, 50Hz, solidly earthed system

h) Construction supply 415 V, 3 phase, 4 wire, 50Hz AC supply with neutral lead solidly earthed.

i) 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.


AC supply	Voltage variation $\pm 10\%$ Frequency variation $\pm 5\%$
DC supply	Combined voltage & frequency variation 10% Voltage variation $+10\%$, -15%


j) For instrument and control system of steam generator and steam turbine generator. 230 V $\pm 5\%$ AC UPS, 1-phase, 50 Hz, 2-wire. The 24 V DC required for control system shall be generated from this UPS.

10.0 All the electrical equipment shall be designed for 50° C reference ambient temperature.

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	TECHNICAL SPECIFICATIONS	SPECIFICATION NO.:	PE-TS-392-100-N002		
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<div>SECTION C</div> <div>SPECIFIC TECHNICAL REQUIREMENTS</div> <div>C1: SPECIFIC TECHNICAL REQUIREMENTS FOR PUMPS</div> <div>C2: SPECIFIC TECHNICAL REQUIREMENTS FOR MOTORS</div>					

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<p>SECTION C1</p> <p>SPECIFIC TECHNICAL REQUIREMENTS FOR PUMPS</p>					

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1.0 SPECIFIC TECHNICAL REQUIREMENTS:

DELIVERY:

Delivery of miscellaneous pumps shall be as per NIT requirement.


The delivery periods shall be as per NIT requirements , considering 8 weeks cumulative approval time taken by BHEL & Customer for the project.The cumulative approval time shall be the time taken by BHEL/ Customer for all the submitted revisions put together.

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

PACKAGE	BHEL DRG NO	DRG TITLE	Drg Sch for Vendors
MISC.PUMPS (HORIZONTAL)	Primary Documents - affecting Manufacturing/ Delivery Directly		
	PE-V6-392-100-N001	TDS AND PERFORMACE CURVES- MISC. PUMPS	R-0 within 20 days from LOI/PO & subsequent revisions within 10 days of comments received from BHEL.
	PE-V6-392-100-N002	GENERAL ARRANGEMENT AND CROSS SECTIONAL- PUMPS	
	PE-V6-392-100-N003	TDS AND CURVES OF MOTORS FOR MISC. PUMPS	
	PE-V6-392-100-N004	QP-MISC PUMPS	
	Secondary Documents - NOT affecting Manufacturing/ Delivery Directly		
	PE-V6-392-100-N005	QP- MOTORS	R-0 within 20 days of Cat-I (or) II approval on motor document.
	PE-V6-392-100-N006	MOTOR TYPE TEST DOC (if applicable)	
	PE-V6-392-100-N007	O& M MANUAL -HOR. PUMPS	Within 30 days from MDCC
MISC.PUMPS (VERTICAL)	Primary Documents - affecting Manufacturing/ Delivery Directly		
	PE-V7-392-100-N001	TDS AND PERFORMACE CURVES- MISC. PUMPS	R-0 within 20 days from LOI/PO & subsequent revisions within 10 days of comments received from BHEL.
	PE-V7-392-100-N002	GENERAL ARRANGEMENT AND CROSS SECTIONAL- PUMPS	
	PE-V7-392-100-N003	TDS AND CURVES OF MOTORS FOR MISC. PUMPS	
	PE-V7-392-100-N004	QP-MISC PUMPS	
	Secondary Documents - NOT affecting Manufacturing/ Delivery Directly		
	PE-V7-392-100-N005	QP- MOTORS	R-0 within 20 days of Cat-I (or) II approval on motor document.
	PE-V7-392-100-N006	MOTOR TYPE TEST DOC (if applicable)	
	PE-V7-392-100-N007	O& M MANUAL -HOR. PUMPS	Within 30 days from MDCC

*For pumps where HT motor is to be free issue by BHEL, HT motor GA will only affect the GA drawing preparation from vendor. Vendor to furnish tentative GA drawing for pump within specified time schedule. Vendor to furnish final GA drawing within 2 weeks of receipt of Motor GA drawing from BHEL. Bidders to note that HT motors inputs viz. Load Torque vs. speed curves of the pumps, selected motor ratings, rpm, GD2 value of driven equipment furnished along with offer shall be considered final and BHEL may proceed with final motor designs as per same.

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.

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2.0 Horizontal Pumps:

2.1 Horizontal Pumps with Mechanical seal shall be supplied with gland packing arrangement to site and gland packing arrangement shall be replaced by vendor with mechanical seal arrangement at site after commissioning of the pumps with gland packing. However Mechanical seal shall be despatched alongwith main supply for this purpose. Shaft sleeve and any other item required for satisfactory operation of Mechanical seal after replacement at site shall be provided by the pump supplier without any cost implication to BHEL.

2.2 End Customer specific requirements are also to be complied. Same are attached as Annexure I.

3.0 Vertical Pumps:

3.1 For all Vertical Pumps, Specific speed shall be limited to 6000 US Units & adequate NPSH/ Min submergence shall be ensured at all conditions.

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

3.3 For Vertical pumps no thrust block is being provided. Bidder to design the pump foundation system (base plate, discharge head, foundation bolts etc.) capable of transferring the pump thrust to the concrete pump foundation itself.

4.0 For all HT Motor driven pumps, Pump bearing temperature bearing measurement instruments shall be provided by purchaser. However, Provision for mounting/ Installation of these bearing measurement instruments on the pump shall be provided by the bidder.

SPEC.NO. TCE.M4-105-01	TATA CONSULTING ENGINEERS LIMITED HORIZONTAL CENTRIFUGAL PUMPS	SECTION: D29 SHEET 1 OF 3
<p>1.0 <u>SCOPE</u></p> <p>This specification covers the general design, materials, construction features, manufacture, shop inspection and testing at manufacturer's works and delivery at site of Horizontal Centrifugal Pumps.</p> <p>2.0 <u>CODES AND STANDARDS</u></p> <p>The design, materials, construction, manufacture, inspection, testing and performance of horizontal centrifugal pumps shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment is to be installed. The equipment shall also conform to latest applicable Indian or equivalent standards. Other international standards are also acceptable, if these are established to be equal or superior to the listed standards. Nothing in this specification shall be construed to relieve the VENDOR of this responsibility.</p> <p>3.0 <u>DESIGN REQUIREMENTS</u></p> <p>3.1 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 inter-changeable.</p> <p>3.2 Flow rate versus head curve shall have a stable and continuously rising characteristics towards the shut-off head. In case of unstable (drooping) characteristics the duty point shall be well away from the unstable region. Besides the actual flow rate versus head curve, curves for minimum and maximum impeller diameters shall also be shown.</p> <p>3.3 The shut-off head shall be at least 110% of the differential head.</p> <p>3.4 The required NPSH at duty point shall be at least one (1) metre less than the available NPSH.</p> <p>3.5 The rating of the pump driver shall be the larger of the following :</p> <p>(a) The maximum power required by the pump from zero discharge to run-out discharge at site climatic conditions.</p> <p>(b) 110% of the power required at the duty point at site climatic conditions.</p> <p>3.6 The corrosion allowance for pressure parts shall be 3 mm.</p> <p>3.7 Pumps shall run smooth without undue noise and vibration. Noise level produced individually or collectively shall not exceed 85 dB(A) measured at a distance of 1.86 metres from the source in any direction. The overall vibration level shall be as per zones A and B of ISO 10816-1.</p>		
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TCE.M4-105-01	HORIZONTAL CENTRIFUGAL PUMPS	SHEET 2 OF 3

3.8 In case of fire water pumps, pumps and drivers with all the accessories shall meet the requirements of Tariff Advisory Committee (TAC) or any other standard as called for in data sheet A. Pump type shall be as approved by TAC.

4.0 **CONSTRUCTION FEATURES**

4.1 In addition to static balancing, impeller and balancing drum shall be balanced dynamically at or near the operating speed.

4.2 Pump shall be provided with renewable type casing ring. Pump having capacity 1,000 M³/Hr and above shall be provided with impeller ring in addition to casing ring. The hardness of impeller ring shall be 50 BHN higher than that of casing ring.

4.3 Pump casing shall be provided with drain and vent connection with plugged or valve connection.

4.4 Bearing shall be oil-lubricated or grease-lubricated and shall have a life of 40,000 hours of working. In case of oil-lubricated bearing, constant oil leveller with magnetic drain plug shall be provided.

4.5 Replaceable shaft sleeves shall be provided to protect the shaft where it passes through stuffing box.

4.6 Stuffing box shall be of such design that it can be repacked without removing any part other than the gland and lantern ring.

4.7 Mechanical seals shall be provided if called for in data sheet - A. If required, a flushing line shall be furnished, complete with strainer and orifice, from the pump discharge to the sealing face. When pumping liquid is not suitable for this purpose, a flushing connection shall be provided so that it can be connected to an external source. Auxiliary piping and plan shall be in accordance with appendix - D of API 610.

4.8 The allowable loads on the pump nozzles shall be at least twice the values listed in the relevant tables of API 610 without reference to any other criterion. The base plate shall be designed to cater to the above increased loads.

4.9 All pumps, except for back-pull out type, shall be provided with flexible coupling. Back-pull out type pumps shall be provided with spacer type coupling.

4.10 Coupling guard made of expanded metal and bolted to the base plate shall be furnished for all coupled pumps.

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SPEC.NO. TCE.M4-105-01	<table border="1"> <tr> <td data-bbox="358 90 1156 138"> TATA CONSULTING ENGINEERS LIMITED </td> </tr> <tr> <td data-bbox="358 138 1156 228"> HORIZONTAL CENTRIFUGAL PUMPS </td> </tr> </table>	TATA CONSULTING ENGINEERS LIMITED	HORIZONTAL CENTRIFUGAL PUMPS	SECTION: D29 SHEET 3 OF 3
TATA CONSULTING ENGINEERS LIMITED				
HORIZONTAL CENTRIFUGAL PUMPS				

4.11 In addition to accessories listed in data sheet A, any other accessories required for safe and efficient operation of pump shall be provided.

4.12 All incidental piping and valves required for sealing, lubrication and cooling for stuffing box packing and/or bearing of pump shall be furnished by the VENDOR.

4.13 Leakage from the pump shall be led to the nearest surface drain by OTHERS. Pump VENDOR shall provide necessary arrangement like drip tray, base plate drain connection etc.

5.0 **TESTS AND INSPECTION**

5.1 Hydrotest pressure on casing shall be 1.5 times maximum discharge head or twice differential head whichever is higher. (Maximum discharge head = shut-off head + maximum suction head). Unless otherwise stated in data sheet A, the hydrostatic tests on the casing shall be conducted for a minimum duration of 30 minutes.


5.2 The pumps shall be tested as per IS 5120, at rated speed at MANUFACTURER's works to measure capacity, total head, efficiency and power. The negative tolerance on efficiency shall be limited to 2.5% and not 5% as indicated in IS 5120. These tests shall form the basis for acceptance of pumps except for vibration and noise. The pumps shall be tested over the range covering from shut-off head to the maximum flow. The duration of the test shall be minimum one (1) hour. Minimum five (5) readings approximately equidistant shall be taken for plotting the performance curves.

5.3 After installation, the pumps shall be subjected to testing at site also. If the site performance is found not to meet the requirements regarding vibration and noise as specified, the equipment shall be rectified or replaced by the VENDOR, at no extra cost to the PURCHASER.

6.0 **PERFORMANCE GUARANTEE**

Performance parameters to be guaranteed by the VENDOR and tolerances permitted shall be as indicated in section C and/or data sheet A. BIDDER shall confirm acceptance of these by indicating values in data sheet B. Pump or any portion thereof is liable for rejection, if it fails to give any of the guaranteed performance parameters.

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MISCELLANEOUS PUMPS

SECTION C2

SPECIFIC TECHNICAL REQUIREMENTS FOR MOTORS



**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
MISC PUMPS
2x660MW SURATGARH TPS**

SPECIFICATION NO.

VOLUME NO. : **II-B**

SECTION : **C**

REV NO. : **00** DATE : 09.09.13

SHEET : 1 OF 1

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Erection and Commissioning spares.
- e) Erection & Maintenance tools & tackles.
- f) Electrical load requirement for Misc Pumps.
- g) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- h) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer /BHEL approval without any commercial and delivery implications to BHEL
- i) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.

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

Refer “Electrical Scope between BHEL and Vendor”.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

3.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/quality assurance requirements stipulated. In line with this two signed and stamped copies of the following shall be furnished by the bidder as technical offer:

- a) A copy of this sheet “Electrical equipment Specification for Misc 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

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 :

- a) Electrical Scope between BHEL and Vendor”
- b) Standard Specification for Motors (**PE-SS-999-506-E101, VOL-IIB, SEC-D**)
- c) Motors data sheet-A
- d) Motors data sheet-B
- e) Quality Plan (motors below 55kW & motors above 55kW)
- f) Load data format.
- g) Motor & cable customer specification

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PROJECT: 2x660 MW SURATGARH TPS

PACKAGE: MISC PUMP

<u>S.NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1	LT MCC	BHEL	BHEL	DOL starters for motors and 415V supply feeders for the requirements like control panel will be provided by BHEL. The starters for motors shall be located in MCC. Vendor to furnish the load list. 415V MCC is 3ph, 3wire. 1-phase power requirement (required for space heater/ lighting/ any other etc) shall be taken care by vendor at their end.
2	Local push button station (for motors)	BHEL	BHEL	Located near the motor
3	Power cables, ordinary control cables and screened control cables between equipments supplied by vendor.	Vendor	BHEL	
4.	Power cables, ordinary control cables and screened control cables between equipments supplied by vendor & BHEL.	BHEL	BHEL	
5	Any special type of cable like compensating. Co-axial, prefab, MICC and fibre optical	Vendor	BHEL	
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.	BHEL	BHEL	
7	Conduits and conduit accessories for cabling between equipments by vendor	Vendor	BHEL	Cabling shall be through conduits. However, vendor can use the trunk routes available for laying of cables.
8	Equipment earthing.	BHEL	BHEL	
9	Motors with Base frame and fixing hardware for motors.	Vendor	BHEL	1) Makes shall be subject to customer/BHEL approval at contract stage. 2) Motor shall comply the specification Motors (PE-SS-999-506-E101, VOL-IIB, SEC-D)
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 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	BHEL	1. Double compression Ni-Cr plated brass glands. 2. Heavy duty tinned long barrel copper lugs for power & control cables.

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

	TITLE LV MOTORS <u>DATA SHEET-A</u>		SPECIFICATION NO.	
			VOLUME	II B
			SECTION	D
			REV NO. 00	DATE 09/09/2013
			SHEET 1	OF 1
1.0	Design ambient temperature	:	50 °C	
2.0	Maximum acceptable kW rating of LV motor	:	<160KW	
3.0	Installation (Indoors/ Outdoors)	:	As required	
4.0	Degree Of Protection	:	IP55 - Outdoor IP54 – Indoor	
5.0	Cooling	:	TEFC	
6.0	Details of supply system			
	a) Rated voltage (with variation)	:	415V \pm 10%	
	b) Rated frequency (with variation)	:	50 Hz (Variation: +5% TO –5%)	
	c) Combined voltage & freq. variation	:	10% (sum of absolute values)	
	d) System fault level at rated voltage	:	50 kA for 1 sec	
	e) Short time rating for terminal box	:	50 kA for 0.25 sec	
	f) LV System grounding	:	Solidly	
7.0	Class of insulation	:	Class 'F', with temp rise limited to class B.	
8.0	Minimum voltage for starting (As percentage of rated voltage)	:	85% of rated voltage	
9.0	Power cables data	:	Shall be given during Detailed engg.	
10.0	Earth Conductor Size & Material	:	Shall be given during Detailed engg.	
11.0	Space heater supply(30KW & ABOVE)	:	240 V, 1 Φ , 50 Hz	
12.0	Rating up to which Single phase motor	:	Acceptable below 0.20 Kw	
13.0	TYPE OF STARTER PROVIDED IN MCC	:	DOL	
14.0	Locked rotor current			
	a) Limit as percentage of FLC	:	600% (inclusive of tolerance)	
	b) Permissible tolerance, if any	:	-	
15.0	Additional tests	:	As per QP	
16.0	Flame-proof motor			
	a) Enclosure suitable (As per IS:2148)	:	As per requirement	
	b) Classification of Hazardous area (As per IS: 5572 part-I)	:	As per requirement	
	c) Degree of protection	:	IP65	
17.0	Makes	:	AS PER CUSTOMER APPROVED LIST OF MAKE	



TITLE

LV MOTORS**DATA SHEET-A**

SPECIFICATION NO.

VOLUME II B

SECTION D

REV NO. 00 DATE 09/09/2013

SHEET 2 OF 1

18.0 Terminal box : Suitable to rotate at 90 degrees

19.0 Paint shade : Shade 631 of IS-5

LT motors for continuous duty (S1) operation & S3 (intermittent periodic duty) with a cyclic duration factor of 80% or higher, shall be energy efficient class – IE-3 in line with IS: 12615-2011.

All LT motors shall be controlled as follows:

- a) Up to 50kW: - MPCB + Contactor (MPCB shall be with adjustable S/C and O/L protection).
- b) 50kW to 90kW shall have MCCB+ contactor+ bimetallic relay.
- c) 90Kw to 160kW shall have ACB +motor protection relay (MPR).

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D26
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan LIST OF SUB VENDORS / SUB CONTRACTORS	SHEET 7 OF 10

Sl. No.	EQUIPMENT	VENDOR
29.	LV SWITCHGEAR- Non draw out DBs such as Space heater DBs, Lighting DBs, AC & DC distribution boards (TVDB & BVDB excluded), Workshop MCC, Admin building PCC, Welding DBs, Receptacle DBs)	L&T LTD, MUMBAI SIEMENS LTD., MUMBAI CONTROL SWITCHGEAR CO., NEW DELHI SCHNEIDER GE POWER SPACE AGE
30.	MV SWITCHGEAR (11kV & 6.6kV)	ABB, NASIK SIEMENS LTD., MUMBAI BHEL AREAVA, T&D
31.	ELECTRIC MOTORS (HT & LT)	BHEL CGL KEC ABB SIEMENS AREVA (MARATHON)
32.	CABLE END TERMINATION KITS	RAYCHEM LTD, MUMBAI
33.	CABLE GLANDS	COMET DOWELS
34.	ELECTRIC ACTUATORS	AUMA LTD., BANGALORE ROTORK LTD., MUMBAI LIMITORQUE LTD., FARIDABAD
35.	LV/MV CTS /PTS	PRAGATHI INDUSTRIES, KOLKATTA JYOTHI LTD., BARODA GILBERT & MAXELL, BARODA PRECISE ELECTRICALS PRAYOG ELECTRIC BOMBAY

ISSUE
R1



**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
MISC PUMPS
2x660MW SURATGARH TPS**

SPECIFICATION NO.

VOLUME NO. : **II-B**

SECTION : **C**

REV NO. : **00** DATE : 09.09.13

SHEET : 1 OF 1

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

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D13
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Units 7 & 8, at Suratgarh, Rajasthan MOTOR & ACTUATOR	SHEET 1 OF 7
<p>1.0 <u>AC & DC MOTORS</u></p> <p>1.1. HT motors of rating above 1500kW shall be suitable for 11kV, 3 phase, 50Hz power supply. Motors above 160kW and up to 1500kW shall be suitable for 6.6kV, 3 phase, 50Hz. Motors rated 160kW and below shall be suitable for 415V, 3 phase, 50 Hz power supply.</p> <p>1.2. All LT motors shall be energy efficient class – I in line with IS: 12615. However, the starting current shall be limited to 600% (inclusive of 20% tolerance) of full load current.</p> <p>1.3. The motor rating shall be arrived at considering 15% margin over the duty point input or 10% over the maximum demand of the driven equipment, whichever is higher, considering highest system frequency. Motors shall be capable of starting and accelerating the load with the applicable method of starting without exceeding acceptable winding temperatures when supply voltage is 80% of the rated voltage for HT motors and 85% for LV motors. HT motors shall also be capable of satisfactory operation at full load at a supply voltage of 80% of the rated voltage for 5 min. commencing from hot condition. DC motors shall be suitable for the DC system voltage of 220V. Motor shall be capable of starting and accelerating the load with the applicable method of starting, without exceeding acceptable winding temperatures, when the supply voltage is in the range of 85% to 110% of rated motor voltage.</p> <p>1.4. Motors shall be capable of running for one second if the supply voltage drops to 70% of the rated voltage. If such operation is envisaged for a period of one second, the pull out torque of the motor shall be at least 205% of full load torque.</p> <p>1.5. Motors shall withstand for 1 second the voltage and torque stresses developed due to the vector difference between the motor residual voltage and the incoming supply voltage equal to 150% of the rated voltage during fast changeover of buses.</p> <p>1.6. Locked rotor current of the HT motors rated 1500 kW and below shall be limited to 600% (inclusive of 20% tolerance) of the full load current of the motors and motor rated above 1500 kW shall be limited to 450% (inclusive of 20% tolerance) of full load current of the motor.</p> <p>1.7. The locked rotor withstand time under hot condition at 110% rated voltage shall be more than the starting time at minimum permissible voltage specified above by at least three seconds or 15% of the accelerating time whichever is greater. Provision of speed switch shall be avoided to the extent possible.</p> <p>These motors shall be designed to withstand at least 5% harmonics in the supply voltage.</p> <p>1.8. The degree of protection for the motor enclosure (including terminal box) shall be IP-55 for outdoor. For single core cable termination, gland plates shall be of non-magnetic material. All motors located in hazardous area shall have flame proof enclosure.</p>		
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SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D13
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Units 7 & 8, at Suratgarh, Rajasthan MOTOR & ACTUATOR	SHEET 2 OF 7
<p>1.9. All HT motors shall be provided with vibration pads for mounting vibration detectors. Vibration monitoring devices shall be provided on DE and NDE side in X & Y direction with remote DCS monitoring, alarms and tripping</p> <p>1.10. Motors rated 1000kW and above shall be provided with differential protection. These motors shall be provided with star connected stator windings. The 3 nos. current transformers, one for each phase shall be mounted in a separate compartment in the neutral side terminal box. The three phases shall be connected to form the star point after they pass through the CTs. The CTs shall be of relay accuracy and the CT characteristics shall be compatible with the differential relay. The additional 3 nos. CTs of identical characteristics shall be provided in the 11kV/6.6 kV switchgear panel.</p> <p>1.11. The terminal box of motor shall be of suitable size, suitable to terminate and maintain the cables easily. Terminal box shall be suitable to rotate at 90 degrees.</p> <p>1.12. The ring oiling system shall be adequate for starting and continuous operation of the motor for at least one half hour without pressure oiling system in operation.</p> <p>1.13. For 11kV & 6.6 kV motors, 6-nos. duplex RTD s for winding shall be provided for remote monitoring, alarm and tripping at DCS. Each bearing shall be provided with one duplex RTD for temperature remote monitoring, alarm and tripping at DCS. 6 nos. spare RTDs shall be provided for winding in HT motors.</p> <p>1.14. The maximum double amplitude vibrations for motors shall be as per IS 12075.</p> <p>1.15. Maximum noise level measured at a distance of 1.5 meter from the outer surface of the motor shall not exceed 85 db (A).</p> <p>1.16. Cable boxes of all 11kV & 6.6 kV motors shall be Phase segregated & shall be provided with quick disconnecting type terminal connectors to facilitate easy disconnection and removal of the motors without requiring unsealing or otherwise disturbing the external cable connections and leaving the phase segregated terminal box intact. The terminal boxes shall have fault withstand capacity equal to at least rated short circuit level of system voltage for 0.25 sec. The terminal boxes shall be reversible to suit cable entry from top or bottom and suitable for termination of FRLS, XLPE armoured cables.</p> <p>1.17. The star connection side terminal box should have sufficient capacity to accommodate CT's for differential protection for motor above 1000kW.</p> <p>1.18. The insulation system for 11000 V AC & 6600 V AC motors shall withstand the negative or positive 0.3 / 3.0 microsecond wave (2.7 pu rated peak line to earth operating voltage) switching surges originating from non-effectively earthed power system. All 11000V AC & 6600 V AC motors shall have BIL and power frequency withstand voltage as per relevant standards.</p> <p>1.19. Motor bearing shall be insulated wherever required.</p> <p>1.20. All HT motors shall be with VPI insulation or better</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D13
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Units 7 & 8, at Suratgarh, Rajasthan MOTOR & ACTUATOR	SHEET 3 OF 7
<p>1.21. All HT motors / LT motors 15 kW and above shall be provided with external greasing arrangement</p> <p>1.22. CACW motor shall be provided with water leakage detector with remote alarms and tripping.</p> <p>1.23. All HT motors / LT motors 30 kW and above shall be provided with space heaters using 240 V AC supply. However, for all the actuators, irrespective of its rating, space heaters shall be provided using 240V AC supply.</p> <p>1.24. All motors below 15 kW shall be provided with sealed ZZ bearings</p> <p>1.25. Each motor shall have two earthing terminals.</p> <p>1.26. All motors for outdoor duty shall have detachable metal canopy.</p> <p>1.27. HT motors shall be designed for operation as follows:</p> <ol style="list-style-type: none"> Upto 1000kW – Vacuum circuit breakers/SF6. Above 1000kW-Vacuum circuit breakers/SF6. All motors shall be suitable for DOL starting. <p>1.28. Separate terminal boxes to be provided for space heater, RTDs for windings/bearings, vibration monitors etc. All terminal boxes shall be provided with two earth studs for termination of protective earth conductor. Double compression type brass cable glands and crimping type copper lugs shall be provided for termination.</p> <p>1.29. Provision shall be made at DCS to monitor, integrate running hours, nos. of starts and stop recording for all motors.</p> <p>1.30. The terminals of all motors shall be suitable for terminating Aluminium conductor, XLPE insulated, armoured cables, the sizes of which will be intimated by the Purchaser.</p> <p>2.0 <u>ACTUATOR</u></p> <p>2.1. GENERAL TECHNICAL REQUIREMENT</p> <p>2.1.1. Actuator shall be weatherproof type with enclosure conforming to IP-64 degree of protection. It should be suitable for out-door use without the need for canopy. If the IP-68 degree of protection is required due to occasional submergence, the purchaser shall specify the depth and duration of such submergence.</p> <p>2.1.2. The actuator shall be suitable for installation in any position without lubrication leakage or other operational difficulty.</p> <p>2.1.3. All actuators shall be supplied with non integral starters for open & close. The main gearbox of the actuator shall be special grease filled.</p> <p>2.1.4. Each actuator should have a hand wheel for emergency manual operation. Clockwise operation of hand wheel shall cause clockwise movement of the</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D13
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Units 7 & 8, at Suratgarh, Rajasthan MOTOR & ACTUATOR	SHEET 4 OF 7
<p>output drive. The hand wheel shall be clearly marked with an arrow and the word CLOSE.</p> <p>2.1.5. The hand wheel shall automatically disengage when the power to the motor is restored i.e. power drive shall have a preference over manual drive.</p> <p>2.1.6. The manual effort should not exceed 400 N (push / pull). A top bevel gear set (side mounted hand wheel) shall be employed to reduce the manual effort.</p> <p>2.1.7. Each actuator shall have a local mechanical position indicator. It should be suitable to indicate 0 - 100% position of the valve (continuous type).</p> <p>2.1.8. In order to minimise the amount of spare parts required, parts and sub-assemblies limit / torque switches, limit switch counter gear assembly, torque switch drive assembly, mechanical position indicator assembly etc. individually interchangeable / replaceable throughout the models selected.</p> <p>2.1.9. The actuator shall be painted with corrosion resistant epoxy resin paint. Paint shade shall be Grey (Shade 631) as per IS-5.</p> <p>2.1.10. In order to prevent condensation, a space heater shall be provided in the switch compartment, suitable for continuous operation. Actuator mounting dimensions shall be according to ISO-5210. For rising stem applications, the design must allow the removal of actuator from the output drive without disturbing the function of valve.</p> <p>2.2. LIMIT AND TORQUE SWITCHES</p> <p>2.2.1. Independent torque and limit switches shall be provided in the actuator. A minimum of two position limit switches and two torque switches, one each for each direction of travel, having 4 NO + 4 NC potential free contacts, shall be supplied. If called for in the data sheet, two additional limit switches shall be provided for intermediate positions.</p> <p>2.2.2. Torque switch dial shall be graduated directly in "kg-m" for easy setting to desired value within the range specified. Separate dials shall be provided for CLOSE and OPEN torque switches.</p> <p>2.2.3. Two additional limit switches with 2NO + 2NC contacts, each adjustable at any intermediate position, shall be provided in the actuator.</p> <p>2.2.4. The rating of both torque and limit switches shall be 240 V AC, 5 Amps. The switches shall individually be enclosed to a minimum of IP-64 protection class.</p> <p>2.2.5. Torque and limit switches shall have only stainless steel flaps for better protection against environmental condition.</p> <p>2.2.6. Limit switches shall be operated by gear driven cams, which are mechanically linked to the driving devices. The counter gear used for counting and tripping the limit switches shall be of metallic construction like brass etc. No plastic gearing shall be allowed.</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D13
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Units 7 & 8, at Suratgarh, Rajasthan MOTOR & ACTUATOR	SHEET 5 OF 7
<p>2.2.7. To guarantee proper function under high ambient temperatures, torque and limit switch sensing shall be of mechanical type.</p> <p>2.3. ELECTRIC DRIVE FOR ACTUATOR (MOTOR)</p> <p>2.3.1. All motors shall be specifically designed for valve actuator operation, which is characterised by high starting torque, low stall torque & low inertia. All motors shall be high starting torque type to facilitate 'unseating' of valve.</p> <p>2.3.2. Motor shall be suitable for power supply of 415 V, 3 ph, 50 Hz, AC.</p> <p>2.3.3. Motor shall be squirrel cage induction type and shall generally conform to IS-325.</p> <p>2.3.4. Motor shall have minimum class 'F' insulation with temperature rise restricted to class 'B' under the design ambient temperature.</p> <p>2.3.5. Motor shall be of totally enclosed surface cooled (TESC) type with IP-67 protection class after mounting on actuator.</p> <p>2.3.6. Motor shall have three thermostats connected in series, one in each phase of stator winding, for protection against overheating.</p> <p>2.3.7. Motor shall be suitable for operation under voltage variation of + 10%, frequency variation of + 5% and combined voltage & frequency variation of 10% absolute.</p> <p>2.3.8. Motor shall be suitable for direct on-line (DOL) starting and starter shall be non integral to the motor.</p> <p>2.3.9. It should be possible to separate the motor from the lubricant filled gearing of the actuator allowing easy replacement of motor without losing any lubricant regardless of mounting position.</p> <p>2.3.10. Finish shall be provided on the motor body to ensure better heat dissipation.</p> <p>2.3.11. It shall be possible to change the output rpm of the actuator, if required, at the site at a later date, without hampering the mounting arrangement and loss of any lubricant.</p> <p>2.4. CODES & STANDARDS</p> <p>All the equipment specified herein shall comply with the requirements of the latest issue of the relevant National & International standards.</p> <p>The design and materials used for the components shall also comply with the relevant National & International standards.</p> <p>As a minimum requirement, the following standards shall be complied with :</p> <p>Electric motor operated actuators:IS 9334</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D13
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Units 7 & 8, at Suratgarh, Rajasthan MOTOR & ACTUATOR	SHEET 6 OF 7
<p>Degrees of protection provided by enclosures at low:IS 2147 voltage switch gear and control gear</p> <p>Flame Proof enclosure at electrical apparatus:IS 2148 Specification for three phase induction motors:IS 325</p> <p>AC contactor for voltages not exceeding 1000 V:IS 2959</p> <p>Degree of protection provided by enclosures for :IS 4691 Rotating electrical machinery</p> <p>Specification for rotating electrical machines:IS 4722 For other code refer Section D28.</p> <p>2.5. OTHER REQUIREMENTS OF ACTUATOR.</p> <p>2.5.1. Common potential free contact shall be available to annunciate the fault condition to the remote control station or DCS.</p> <p>2.5.2. The following individual relay / potential free contacts shall be provided for the remote indication:-</p> <ul style="list-style-type: none"> - Actuator OPEN. - Actuator CLOSE - Actuator fault feed-back - Thermal overload relay shall be provided to trip the actuator in case of overload <p>2.6. The DC and AC actuator shall be provided with accessories viz., Torque limit switch, end of travel switch, adjustable limit switch, hand wheel motor, thermostat, etc. Complete actuator shall be tested at factory as per IS 9334. All actuators should have minimum 2 limit switches for each position, and should have position transmitters wherever required.</p> <p>3.0 TESTS</p> <p>3.1. All routine & acceptance tests as per relevant IS shall be conducted on motors. For all AC and DC motors of rating below 100kW, type test certificates shall be furnished. If the test reports are not found in order by Purchaser then these tests shall be conducted by the Vendor without any cost implication.</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D13
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Units 7 & 8, at Suratgarh, Rajasthan MOTOR & ACTUATOR	SHEET 7 OF 7
<p>3.2. Type test shall be carried out on one no. of each type and rating of motor of rating 100kW and above, which shall be witnessed by Purchaser.</p> <p>3.3. Efficiency and loss measurements shall be done for all LT motors as per relevant standard (Being energy efficient motors.) as routine test.</p> <p>3.4. For 11000V AC & 6600V AC motors, in addition to all the tests specified above, polarisation index test shall be carried out as a routine test on each motor (the minimum value of polarisation index for all motors shall be 2 when determined according to IS: 7816).</p> <p>3.5. Noise level measurement test shall be conducted on one motor of each type.</p> <p>3.6. Vibration measurement shall be taken for each motor of 45kW & above.</p> <p>3.7. Dielectric tests to establish the insulation withstand level of motors as indicated above shall be performed on a sample coil (identical to those to be used in the motor quoted for) for each type of motor. These tested sample coils shall not be used in the motors to be supplied.</p> <p>4.0 For technical particulars refer datasheet-A.</p>		
		ISSUE R1

SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D16
PART B	RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan CABLE & CABLE CARRIER SYSTEM	SHEET 1 OF 9
<p>1.0 <u>CABLES</u></p> <p>1.1 H T POWER CABLES</p> <p>System cables shall be 11kV (UE) and 6.6 kV (UE) grade suitable for use in medium resistance earthed system, stranded & compacted aluminium conductor, extruded semi conducting screen over conductor, XLPE insulated, semi-conducting followed by copper tape screened, extruded PVC Type ST – 2 inner sheathed, aluminium/GS wire armoured, overall FRLS PVC outer sheathed, conforming to IS 7098 (Part II), IEC-502 for constructional details and tests.</p> <p>1.2 L T POWER CABLES</p> <p>LV Power Cables shall be 1100 V grade, single / multi core, stranded aluminium conductor, XLPE insulated, with PVC inner sheath, armoured and outer sheath made of FRLS PVC compound, generally conforming to IS 7098 (for XLPE). The cables used for DC system shall be of single core type. Minimum conductor cross section of power cables shall be 6-sq. mm for aluminium cables.</p> <p>1.3 CONTROL CABLES</p> <p>Control cables shall be 1100 V grade, multi core, minimum 1.5 sq. mm cross section, stranded copper conductor having minimum 7 strands, PVC insulated, PVC inner sheathed / galvanised steel wire armoured, overall FRLS PVC outer sheathed generally conforming to IS 1554 Part-I. In situations where accuracy of measurement or voltage drop in control circuit warrants, higher cross sections as required shall be used.</p> <p>1.4 INSTRUMENTATION CABLES</p> <p>The instrumentation cables shall be Annealed, tinned stranded copper conductor, 0.5 sq mm , twisted into pairs, overall screened (I1 type) for digital signals, individual and overall screened (for I2 type) for low level analog signals, individual triplet and overall screened (type I3), PVC insulated , inner PVC sheathed, GS wire armoured and overall sheathed with FRLS PVC. The insulation shall be strippable manually as well as by mechanical stripping devices without damage to the conductor.</p> <p>1.5 TRAILING POWER AND CONTROL CABLES FOR MOBILE EQUIPMENT.</p> <p>11 kV(UE) and 6.6 kV (UE) and 1100V-(E) grade power & control flexible trailing, annealed tinned copper conductor, EPR insulated, EPR inner sheathed, CSP outer sheathed and shall have conductor screen of rubber. Cables shall conform to IS requirements and any other applicable standards.</p> <p>1.6 FIRE SURVIVAL CABLES</p> <p>1.6.1 Power and control, single/multi, stranded copper conductor fire survival cables complying with IEC-60331 shall be provided for following systems as per CEA guidelines.</p>		
		ISSUE R1


SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D16
PART B	RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan CABLE & CABLE CARRIER SYSTEM	SHEET 2 OF 9
<p>(a) DC emergency lube oil pumps</p> <p>(b) DC seal oil pumps</p> <p>(c) DC emergency lighting cables for main building</p> <p>(d) Batteries to chargers and DC distribution boards</p> <p>(e) Turbine lube oil pumps</p> <p>(f) Jacking oil pumps</p> <p>(g) Emergency turbine trip by pushbutton in control room</p> <p>(h) Boiler Turbine: Generator inter trip which includes the interconnecting cables between:</p> <ul style="list-style-type: none"> – Boiler master fuel trip and turbine trip relays – Generator trip relays and turbine trip relays – Generator trip relays and 400kV breakers – Generator trip relays and generator field breakers – Generator trip relays and ST and UT breakers <p>1.6.2 FS cables shall have following properties:</p> <p>(a) Excellent fire resistance characteristics</p> <p>(b) Cables shall have features of nontoxic and low smoke generation</p> <p>(c) Flame non-propagation property</p> <p>(d) Ability to withstand burning & continue to function during and after fire</p> <p>(e) Low smoke emission & low halogen property to maintain circuit integrity to essential services under severe fire condition.</p> <p>1.6.3 Construction of FS cables</p> <p>(a) Conductor- Copper stranded</p> <p>(b) Fire proof layer- heat barrier based</p> <p>(c) Insulation- elastomer rubber</p> <p>(d) Fire proof layer- same as 2 above but optional – natural or synthetic, fibre or elastomer</p> <p>(e) Filler- suitable filler optional</p> <p>(f) Binder tape – two layers of glass fibre tape</p> <p>(g) Inner sheath- HOFR FRLS elastomer (heat & oil flame retardant)</p> <p>(h) Armouring/screening – suitable wire</p> <p>(i) Over all sheath – HOFR FRLS</p>		
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<p>1.7 Cables for the fire detection and alarm system and communication system shall be as described else where.</p> <p>2.0 <u>CABLE PROPERTIES</u></p> <p>2.1 All single core power cables shall have wire / strip armouring of aluminium, whereas multi core power cable shall have galvanised steel wire / strip armouring.</p> <p>2.2 The sheath shall be resistant to water, UV radiation, fungus, termite and rodent attack.</p> <p>2.3 The outer sheath of FRLS PVC compound shall meet the following performance requirements:</p> <p>(a) The critical oxygen index value shall be minimum 29 when tested at 27± 2°C as per ASTM-D-2863-77 and the temperature index shall be minimum 250°C at oxygen index value of 21 when tested as per ASTM-D-2863.</p> <p>(b) The maximum acid gas generation as determined by titration method shall be less than 20% by weight when tested as per IEC-60754-1 (1994). Halogen acid content in outer sheath in FS cables shall not be more than 2%.</p> <p>(c) Flammability</p> <p>(i) Cables shall pass tests under fire condition as per IS-10810-Part-53.</p> <p>(ii) Cables shall also pass tests as per IS-10810 Part-61 & Part-62. Category group shall be considered as Category 'A'.</p> <p>(iii) Fire survival cables in addition to tests (i) and (ii) above shall pass tests as per IEC-331.</p> <p>(d) The smoke generation under fire shall have maximum smoke density rating of 60% when tested as per ASTM-D-2843-77 (1977). Smoke density in FS cables shall not exceed 20%.</p> <p>(e) The cables shall pass the ultraviolet tests as per DIN 53387.</p> <p>(f) The cables shall pass the tests for Water absorption tests as per IS 10810.</p> <p>2.4 The finished cable shall pass the flammability test as per IEC-322-1 (1993) and IEEE-383. In addition, it shall also pass flammability test as per Class F3 of Swedish Standard SS-424-1475 (1977).</p> <p>2.5 In addition, cables for devices mounted on or near hot surfaces of Steam Generators, Turbine Generators, Main steam etc shall have heat resistance type outer sheath.</p> <p>2.6 All LT cable shall have embossing at interval of 1 meter for owner name, size/ core type and length.</p>		
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<p>2.7 All cables shall be embossed with the name of RVUNL in addition to what is specified in the standards.</p> <p>3.0 <u>DESIGN CRITERIA FOR CABLE SIZING</u></p> <p>3.1 POWER CABLES</p> <p>Power cable sizes shall be selected on the following basis:</p> <p>3.1.1 Power cables shall carry the full load current of the circuit continuously under site conditions considering the condition listed below:-</p> <ul style="list-style-type: none"> (a) Ambient design temperature 50 deg. C. (b) Maximum allowable temperature under normal full load condition and under short circuit condition based on material selected (XLPE). (c) Maximum short circuit fault current. (d) Ambient temperature for underground cables, 50 deg. C. (e) De-rating factors as per IS/IEC and manufacturer's standard catalogues. <p>3.1.2 Power cables shall withstand the fault current of the circuit for the duration not less than the maximum time taken by the primary protective system to isolate the fault. Fault clearing times for ties between two 6.6 kV switchgears shall be considered as 1 sec. Fault clearing times for ties between two 415V switchgears shall be considered as 0.5 sec.</p> <p>3.1.3 For the cables to 415 V motors and feeders protected by fuses, the cross section shall be chosen according to the cut-off current of the fuse and its fusing time.</p> <p>3.1.4 Voltage drop from transformer secondary to motor terminals during starting of motors will be limited to the following values:</p> <ul style="list-style-type: none"> (a) For HV motors (except MDBFP motor) – 15% of the rated voltage (b) For MDBFP motors – 20% of the rated voltage (c) For LV motors – 15% of the rated voltage. <p>3.1.5 Voltage drop in feeder cables shall be limited to 3% during full load running condition. Voltage drop from transformer secondary to motor terminals during full load running of motors shall be limited to 5 % of rated voltage.</p> <p>3.1.6 For power supply to valve actuator motors, actuators of various isolating and regulating dampers and exhaust fans, 3 core 2.5 sq. mm stranded copper conductor cable may be used in view of ease of termination. These cables shall be in other respects similar to cables described in Clause 1.2 above.</p> <p>3.1.7 Design Calculation for arriving at cable size shall be submitted for purchaser's approval.</p> <p>3.1.8 DC System Cables:-</p>		
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<p>3.1.8.1 1100 V grade, single core cables as specified in LT power cables shall be used from batteries/ battery chargers to main DCDB, between main Distribution Board, from main Distribution Board to sub distribution board, main DC supply to various system cabinets/panels, Switchgears etc and for critical auxiliaries. Flexible cables with PVC insulation shall be used where termination of XLPE/PVC insulated cables is difficult.</p> <p>3.1.8.2 Voltage drop in cables between battery to DCDB and battery charger to DCDB shall be limited to 2%. Voltage drop in cables between DCDB and loads shall be limited to 3%.</p> <p>3.1.8.3 Design Calculation for arriving at cable size shall be submitted for purchaser's approval.</p> <p>3.2 <u>CONTROL CABLES</u></p> <p>3.2.1 Current transformer leads shall be checked for the lead burden vis-a-vis the current transformer VA capacity. In case 2.5 sq. mm conductor impose unacceptably high burden on CTs, 4.0-sq. mm conductor shall be used. The conductor material shall be copper.</p> <p>3.2.2 Voltage transformer leads shall be checked for voltage drop which shall be limited to within 1% for all cases other than tariff metering. For tariff metering the voltage drop shall be limited to 0.2%. In case the voltage drop with 2.5 sq. mm conductors exceed this value, higher conductor sizes shall be used.</p> <p>3.3 <u>INSTRUMENTATION CABLE</u></p> <p>3.3.1 Element identification : As per IEC-60189-2</p> <p>3.3.2 Core wrapping : By non-hygroscopic material by taping or by extrusion</p> <p>3.3.3 Element screening : By copper tape of minimum 0.04mm thickness or by copper laminated plastic tape</p> <p>3.3.4 Rip cord : Non-metallic rip cord under the core wrapping</p> <p>3.3.5 Drain wire : A tinned copper drain wire of minimum 0.05 mm² cross section in contact with each screen of cabling element.</p> <p>Cabling elements shall be any one of the following:</p> <p>A 'Pair' of two insulated conductors twisted together designated by alphabet 'p' printed on a binding tape at 200 mm intervals.</p> <p>A 'Triple' of three insulated conductors twisted together designated by alphabet 't', printed on a binding tape at 200 mm intervals.</p> <p>Maximum length of lay in the finished cable shall be 120 mm.</p> <p>3.3.6 <u>Units</u></p> <p>Cables shall be bunched together in units of twenty cabling elements or sub units of five or ten elements, stranded in concentric layers. The units or sub</p>		
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<p>units shall be designated by p1, p2, p3,. t1, t2, t3...,q1, q2, q3, .., or Q1, Q2, Q3 ..., etc. depending on the combination.</p> <p>3.3.7 <u>Overall screening and armouring</u></p> <p>Cables shall have an overall screen made up of copper/aluminium tape of 0.04 mm thickness or copper/aluminium of 0.008 mm thickness laminated with plastic tape with a minimum overlap of 15%.A drain wire of tinned copper with minimum 0.5 mm² cross section shall be provided in continuous contact with the screen.</p> <p>3.3.8 <u>Inner and Outer Sheath</u></p> <p>The inner and outer sheaths shall consist of black PVC compound.</p> <p>3.3.9 <u>Insulation Resistance</u></p> <p>Minimum insulation resistance per km shall be 500 mega Ohm.</p> <p>3.3.10 <u>Mutual Capacitance</u></p> <p>Mutual capacitance of any pair of conductors shall not exceed 120 nF/km.</p> <p>3.3.11 <u>Capacitance Unbalance</u></p> <p>The capacitance unbalance between any two pairs shall not exceed 400 pF for 500 metre length of cable.The construction, performance and testing of cables except as mentioned above shall generally comply with the following standards :</p> <p>IEC-60189 - Part-1 : Low frequency cables and wires with PVC insulation and sheath. General test and measuring methods</p> <p>IEC-60189 - Part-2: (-do- Cables in pairs and triples).</p> <p>4.0 <u>CABLE TERMINATIONS</u></p> <p>4.1 Cables shall be laid in trays /trenches/ conduits by the Bidder. Also joint markers shall be provided at each joint.</p> <p>4.2 All 1100V termination for XLPE/PVC power cables and control cables shall be by Double compression weather proof type cable glands. Heavy duty, tinned, long barrel copper lugs shall be used for termination.</p> <p>5.0 <u>CABLE JOINTS</u></p> <p>Cable joints shall be avoided to the extent possible. If joints are unavoidable due to circuit length, in excess of permissible maximum drum length, they shall be heat shrinkable types having a short circuit with stand capacity value as specified in clause 3.1.2 above. Lugs shall be heavy duty, tinned copper, long barrel type. All cable glands shall be double compression, weather proof.</p> <p>6.0 <u>POWER RECEPTACLES</u></p>		
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	TECHNICAL SPECIFICATIONS	SPECIFICATION NO.:			PE-TS-392-100-N002	
		VOLUME:		IIB	SECTION:	D
	MISCELLANEOUS PUMPS	REV. NO.		0	DATE:	20.11.13

SECTION D

STANDARD TECHNICAL SPECIFICATIONS

D1: STANDARD TECHNICAL SPECIFICATIONS FOR PUMPS

D2: STANDARD TECHNICAL SPECIFICATIONS FOR MOTORS

	TECHNICAL SPECIFICATIONS	SPECIFICATION NO.:		PE-TS-392-100-N002	
		VOLUME:		IIB	SECTION: D1
		REV. NO.		0	DATE: 20.11.13
		MISCELLANEOUS PUMPS			

SECTION D1


STANDARD TECHNICAL SPECIFICATIONS FOR HORIZONTAL PUMPS NO. PE TS-179-06


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

DATA SHEET A ALONGWITH LIST OF MANDATORY SPARES &
WATER ANALYSIS


DATA SHEET C

QUALITY PLAN

	TITLE: STANDARD TECHNICAL SPECIFICATION HORIZONTAL CENTRIFUGAL PUMPS	SPECIFICATION NO. PES-179-06	
		VOLUME: II B	
		SECTION: D	
		REV. NO. 03	DATE: 16.07.2012
		SHEET 1 of 14	
1.00.00 GENERAL INFORMATION			
1.01.00	The general guidelines as illustrated in the subsequent clauses of this section shall be applicable for horizontal centrifugal 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-1520/1980:	Horizontal Centrifugal pumps for clear, cold and fresh water.	
2.01.02	IS-5120/1977:	Technical requirements for Rotodynamic special Purpose pumps.	
2.01.03	IS-5639/1970:	Pumps for handling chemicals & corrosive liquids.	
2.01.04	IS-5659/1970:	Pumps for process water.	
2.01.05	IS-6536/1972:	Pumps for handling volatile liquids.	
2.01.06	IS-9137/1978:	Code for acceptance tests for centrifugal, mixed flow and axial flow pumps- Class 'C'.	
2.01.07	ISO 3555/1977: BS 5316/1977 Part 2	Acceptance test for centrifugal, mixed flow and axial flow pumps - Class 'B' tests.	
2.01.08	ISO 2548/1973: BS 5316/1976 Part 1	- Do - Class 'C' tests.	
2.01.09	API-610/1989:	Centrifugal pumps for general refinery services.	
2.01.10	HIS	Hydraulic Institute Standards, USA	
2.01.11	PTC 8.2/1965:	Power Test Codes - Centrifugal pumps.	
2.01.12	ASTM-1-165-55	Standard Methods for Liquid Penetration Inspection.	
2.02.00	In case of any contradiction with the above standards and annexure, the stipulations in the annexure shall prevail and shall be binding on the bidder.		

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3.00.00	SCOPE OF SUPPLY & SERVICES:
3.01.00	The miscellaneous pumps and drives scope shall be as specified in Data Sheet A /Section A.
3.02.00	The Capacity, Head, Materials of construction and other particulars of pumps are detailed in Data Sheet A of the specification.
3.03.00	Accessories: All the pumps under this specification shall be complete with following standard/special accessories.
3.03.01	Standard accessories: a) LT Electric drives/motors (as applicable) with cable gland and lugs at motor end. (The bare HT drive motors and LT motors not in bidder's scope of supply, wherever required supplied as free issue by BHEL refer Cl. 5.08.00). b) Pump motor coupling along with coupling guard. c) Common base plate for pumps 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, shims 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 topping 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. l) Bidder shall provide various drawings, data, calculations, test reports/ certificates, operation and maintenance manuals, As-built drawings, etc. as specified and as necessary.

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m) Mandatory spares as specified in respective Data Sheet-A of this section.

3.04.00 Services included in Bidder's Scope:

3.04.01 The pumps shall be guaranteed to meet the performance requirements specified vide Data Sheet -A and also for trouble free operation after commissioning. Schedule of performance guarantees (enclosed in Volume-III) duly filled and signed shall be furnished with the bid.

3.04.02 Pumps with Mechanical seal shall be supplied with gland packing arrangement initially to site and gland packing arrangement shall be replaced by vendor with mechanical seal arrangement at site after commissioning of the pumps with gland packing. However Mechanical seal shall be dispatched along with main supply for this purpose.

3.04.03 The pumps erected by the purchaser shall be checked by the bidder for correctness of their installation, alignment, etc. at site prior to their commissioning.

3.04.04 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.

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

3.05.00 Works excluded from Bidder's Scope:


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


4.00.00 BID EVALUATION CRITERIA & LIQUIDATED DAMAGES FOR SHORTFALL:


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


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


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

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<p>Where Q = Rated capacity M³/hr H = Rated TDH, MWC P = Pump Efficiency M = Motor Efficiency. S = Specific Gravity of fluid handled</p> <p>4.02.00 The efficiencies for pumps and motors for arriving at benchmark power for Bid Evaluation shall be as indicated in Data Sheet A for various pumps.</p> <p>No advantage shall be given to the bidder for Aux. Power quoted lower than the Bench mark values calculated with KW calculation formula at Cl. 4.01.00 above, <i>considering the bid evaluation efficiencies for pump and motor as indicated in Data Sheet-A</i>. However the bids shall be evaluated as above if the Aux. Power quoted are higher than Bench mark values.</p> <p>NOTE:</p> <ol style="list-style-type: none"> Efficiencies for HT motors and LT motors not in bidder's scope, for bid evaluation purpose shall be taken based on the maximum value as furnished in Data Sheet A. During contract stage the Guaranteed power consumption of Pumps with BHEL supplied drives (HT/LT) for successful bidder shall be reworked by BHEL as below: <p>Revised guarantee power consumption shall be as per KW calculation formula at Cl. 4.01.00 above, where <i>P = pump efficiency guaranteed by bidder and M = motor efficiency as per approved datasheet of the supplied HT/LT motor.</i></p> <p>4.03.00 Liquidated damages for shortfall in Guaranteed KW</p> <p>The above guaranteed power consumption shall be demonstrated by the successful bidder during performance testing at works/ site.</p> <p>For pumps with BHEL supplied drives, the power consumption shall be compared with the reworked guarantee power consumption, defined as per note no. 2 of Cl. 4.02.00 above for the purpose of shortfall.</p> <p>The liquated damages @ twice the bid evaluation rate as above per KW per working pump shall be levied in the event of failure of bidder to demonstrate the guaranteed power consumption.</p> <p>5.00.00 TECHNICAL REQUIREMENTS:</p> <p>5.01.00 The pumps shall meet the technical requirements of section "D" as well as Data Sheet - A. Wherever there is contradiction between Section D and Data Sheet-A, the latter shall prevail. In the event of any contradiction of section "D" with Section-C, the Section-C will prevail.</p> <p>5.02.00 The pumps shall be Electric motor driven.</p>			

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5.03.00	The Pumps shall conform to HIS. It is bare minimum requirement, however, any other equivalent or stringent standard is also acceptable, if, all the requirements of HIS are also met.		
5.04.00	The horizontal pumps shall be Horizontal split casing type with speeds not exceeding 1500 RPM or as indicated in Data Sheet-A.		
5.05.00	No negative tolerance shall be permitted in rated capacity & TDH.		
5.06.00	No negative tolerance shall be permitted in efficiency at rated capacity.		
5.07.00	The shut off head of pumps shall be more than pump rated TDH and percentage variation may vary depending on the specific speed of the pump as under: i. 10-15% for pumps of specific speed up to 1000 US units, ii. 15-20% for pumps of specific speed in the range of 1000 to 2000 US units, iii. 20-40% for pumps of specific speed in the range of 2000 to 4000 US units, iv. Above 50% for pumps of specific speed in the range of 4000 to 7000 US units.		
5.08.00	All HT motors and those LT motors which are not in bidder's scope of supply : bare motors only, shall be supplied as free issue by BHEL through BHEL, based on ratings and TS (Torque - Speed) curve selected and furnished by the bidders along with their un-priced bid. The responsibility for satisfactory operation for combined performance of pumps & motors shall rest with the bidder only as if, the drive motors also have been supplied by the bidder. Couplings, base plate, foundation bolts, any other fittings, etc. as required shall be supplied by the bidders only. BHEL shall supply one number of each type of drive motors (where drive motor is not in bidder's scope of supply) for shop testing of pumps with job motors. All other motors shall be dispatched by BHEL directly to project sites.		
5.09.00	For all HT motor driven pumps, BHEL has envisaged vibration-monitoring system in their own scope. The bidder shall make provisions for mounting following on the pump/ pump shaft: <ul style="list-style-type: none">• Purchaser's probes in both DE/NDE bearings of pumps• Key slots on pump shaft with dimensions as specified in Data Sheet A.• Other components as finalized during detailing.• For mounting of above on the HT motors, same shall be taken care by BHEL - Bhopal.		
5.10.00	The pumps shall be capable of developing the required total head at rated capacity for continuous operation. The pumps shall operate satisfactorily at any point on the Q-H characteristic curve over a range of 0% to 130% capacity and shall be suitable for continuous operation between 30% to 130% capacity.		

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

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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, unless specified otherwise in Sec-C of the specification or NIT.		
7.00.00	OTHER REQUIREMENTS:		
7.01.00	The quality of water handled by various pumps shall be as per Data Sheet-A.		
7.02.00	The materials of construction for various components specified are the minimum requirements and materials of construction for other components not specified shall be similarly selected by the bidder for the intended duty.		
7.03.00	The makes of various bought out items of bidder (i.e. motor, bearings, mechanical seal etc.) shall be subject to purchaser's approval in the event of order.		
7.04.00	Painting for Pumps		
	a) The surface of SS, Gun metal, brass, bronze and non-metallic component shall not be applied with any painting.		
	b) The Steel surface to be applied with painting shall be thoroughly cleaned before applying painting by brushing, shop blasting etc. as per the agreed procedure.		
	c) For all the steel surfaces inside the (indoor installation) building, a coat of red oxide primes of min. thickness DFT of 50 microns followed up with under coat of Synthetic Enamel paint of min. thickness DFT of 50 microns shall be applied. The top coat shall consist of two coats each of min. thickness DFT of 50 microns of synthetic enamel paint and thus total DFT shall be min. 200 microns.		
	d) For all the steel surfaces exposed to (outdoor installation) atmosphere, a coat of chlorinated rubber based zinc phosphate primer of min. thickness DFT of 50 microns followed up with under coat of chlorinated rubber paint of min. thickness DFT of 50 microns shall be applied. Then, intermediate coat consisting of one coat of chlorinated rubber based paint pigmented with Titanium di-oxide with min. thickness DFT of 50 microns and top coat shall consist of two coats each of min. thickness DFT of 50		

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microns of chlorinated rubber paint shall be provided. Total DFT of paint system shall be min. 200 microns.

7.05.00 It is mandatory for the bidder to submit along with the bid, the deviations if any – whether major or minor in the schedule of deviations only. In the absence of deviations listed in the “Schedule of deviations, the offer shall be deemed to be full conformity with the specification, “notwithstanding” anything else stated elsewhere in bidder’s offer. The implied/indirect deviations shall not be binding on the purchaser.

8.00.00 **PERFORMANCE REQUIREMENTS**

8.01.00 Performance requirements for the pumps shall be as guided in Data sheet - A enclosed with this section.

8.02.00 Pump(s) shall preferably be designed to have the best efficiency at flow within ± 10% of the specified duty point flow. The pumps shall be suitable for continuous operation at any point within the “Range of Operation” as stipulated in the Data Sheet - A attached with this section.

8.03.00 Pump(s) shall preferably have a continuously rising head-capacity characteristics from the specified duty point towards shut-off point, the maximum being at shut-off to enable parallel operation.

Under all circumstances, the ‘range of operation’ of the pumps shall exclude any unstable operating zone of the head-capacity curve.

8.04.00 Wherever specified in the Data Sheet - A attached to this section, pumps of each category shall be suitable for parallel operation. The head vs. capacity, the BHP vs. capacity characteristics etc. shall be identical to ensure equal load sharing and trouble-free operation of any pump when the other pump(s) working in parallel with it trip.


8.05.00 The pump set along with drive motor shall run smooth without undue noise and vibration. Acceptable vibration limits shall be guided by the HIS of USA. Refer clause 5.15.00 above for permissible limits.

9.00.00 **DESIGN AND CONSTRUCTION**


9.01.00 **Pump Casing**


9.01.01 Pump casing shall be provided with adequate number of vents and priming connections with valves unless the pump is made self-venting and priming. Casing drain, as required, shall be provided complete with drain valves. It shall be provided with a connection for suction and discharge pressure gauge as standard feature.


9.01.02 Pump design must ensure that the nozzles are capable of withstanding external reactions not less than those specified in API-610.


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9.01.03	In case where an expansion joint is located at pump discharge, the pump assembly will be subjected to an additional thrust which will be transmitted to the foundation. This additional thrust shall be taken into the consideration of pump design.
9.02.00	Impeller
9.02.01	The Impeller assembly shall be dynamically balanced and designed with critical speed substantially above the operating speed.
9.03.00	Wearing Rings
9.03.01	Replaceable type wearing rings shall be furnished to prevent damage to impeller and casing.
9.04.00	Shaft
9.04.01	Shaft size shall be selected considering that the critical speed shall be away from the operating speed as recommended in applicable Code/Standard. The critical speed shall be at least 30% higher than the rated speed.
9.05.00	Shaft Sleeves
9.05.01	Renewable type fine finished shaft sleeves shall be provided at the stuffing boxes/mechanical seals. Length of the shaft sleeves must extend beyond the other faces of gland packing or seal end plate so as to distinguish between the leakage past Shaft and shaft sleeve and that past the seals/glands.
9.05.02	Shaft sleeves shall be properly fastened to the shaft to prevent any leakage or loosening. Shaft sleeve assembly should ensure concentric rotation.
9.06.00	Bearings
9.06.01	Bearings shall be easily accessible without disturbing the pump assembly. A drain shall be provided at the bottom of each bearing housing.
9.06.02	Heavy-duty sleeve/ball/roller type bearings shall be provided to take care of the radial loads.
9.06.03	In case of sleeve type radial, axial thrust shall be absorbed in suitable hydraulic devices and/or thrust bearings.
9.06.04	Bearings and hydraulic devices (if provided for balancing axial thrust) shall be of adequate design for taking the entire pump load arising from all probable conditions of continuous operation. Life of the bearings shall be guided by the design standard of the pump. Antifriction bearings of standard type, if provided, shall be selected for a minimum

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life 20,000 hrs. of continuous operation at maximum axial and radial loads at rated speed. Thrust bearing shall be capable of running continuously at maximum load.			
9.06.05	The bearing shall be oil/grease lubricated. Suitable lubricating arrangement for the bearings shall be furnished with the pump complete with all accessories like pump, filters, piping, fittings, valves, interlocking and supervising instruments etc. as necessary. The design shall be such that the bearing lubricant does not contaminate the liquid being pumped.		
9.06.06	Bearings of reputed makes are to be provided, same shall be indicated in Technical Data sheet to be furnished by the successful bidder after award of LOI/ PO, subject to acceptance of BHEL/ end customer, without any price implication to BHEL.		
9.07.00	Stuffing Boxes		
9.07.01	Stuffing box design shall permit replacement of packing without removing any part other than the gland.		
9.07.02	Stuffing boxes shall be sealed/cooled by the fluid being pumped/external clear water, as specified in the Annexure. All necessary pumps, piping, fittings, valves, instruments etc. as required for safe and trouble-free operation of the pumps and as specified in the Annexure shall be included in the scope of supply.		
9.08.00	Mechanical Seals		
9.08.01	Mechanical seals (cartridge type) shall be provided if specified in the Data Sheet-A of this section. The pump supplier shall co-ordinate with the seal maker in establishing the direct circulation rate for maintaining a stable film at the seal in the chamber. The seal piping system shall form an integral part of the pump assembly.		
9.08.02	When handling liquids near boiling point, suitable arrangement for external cooling shall be provided so as to prevent flashing at the seal faces.		
9.08.03	For the seals under vacuum service, the seal design must ensure sealing against atmospheric pressure, even when the pumps are not operating.		
9.08.04	Pumps with Mechanical seal shall be supplied with gland packing arrangement initially to site and gland packing arrangement shall be replaced by vendor with mechanical seal arrangement at site after commissioning of the pumps with gland packing. However Mechanical seal shall be dispatched along with main supply for this purpose. The special tools (if any) required for above shall be arranged by bidder.		
9.08.05	Mechanical seals of reputed makes are to be provided, same shall be indicated in Technical Data sheet to be furnished by the successful bidder after award of LOI/ PO, subject to acceptance of BHEL/ end customer, without any price implication to BHEL.		
9.09.00	Drive Unit		

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9.09.01	The pumps shall be driven by electric motor directly coupled as specified in the Data Sheet-A of this section. A heavy duty coupling along with coupling guard shall be provided between the pump and drive unit.		
9.09.02	Unless otherwise specified in Data Sheet-A of this section, drive unit power rating shall be the maximum of the following requirements. a) 15% margin over the pump shaft input power at the rated duty point. b) 5% margin over the maximum pump shaft input power required within the 'Range of Operation'. c) Pump shaft input power required considering the overloading of the pump assuming single pump operation in the event of tripping of one or more of the pumps operating in parallel.		
9.10.00	Coupling for pump & Motor Shaft		
9.10.01	The pump and motor shafts shall be connected with adequately sized flexible coupling of proven design with spacer to facilitate dismantling of the pump without disturbing the motor. Necessary coupling guard shall be provided.		
9.10.02	No. of coupling holes for joining coupling hubs shall be even in number and preferably in multiples of four.		
10.00.00	INSPECTION AND TESTING		
10.01.00	The Quality Plans enclosed in the specification are for bidder's guidance only. The bidder shall comply with these and other minimum requirements specified in the specification and shall furnish his own quality plan in the event of order based on the guidance given as above, for approval by BHEL/Customer.		
10.02.00	The Bidder shall carry out the following specific tests inspections to ensure that the equipment furnished lies in strict conformance with the specification and also in accordance with applicable codes/standards and good engineering practice. a) Identification and Testing i) All materials used for pump construction shall be of tested quality. Material shall be tested as per the relevant standard and test certificates shall be made available to the Owner. ii) 100% PMI (Process Material Identification) inspection for material grade of pump casing, shaft and impeller shall be done by vendor & certification shall be submitted for review of BHEL. Further BHEL reserves the right to conduct		

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		<p>random & independent PMI inspection on pump casing, shaft and impeller to ascertain the grade of material during inspection at vendor works.</p> <p>iii) Tests for each pump included under this section shall include but not be limited to the following:</p> <ul style="list-style-type: none"> - The entire surface of the impeller / casing / diffuser castings shall be subjected to Dye Penetration Test as per ASTM Specification no.:1-165-65. - Shaft coupling & other active components shall be subjected to Dye Penetration and Ultrasonic Tests. - Wearing rings, shaft sleeves shall be subjected to Dye Penetration Test. - Fabricated components of pumps shall be subjected to Dye Penetration test on weld. - Verification of material, witnessing of pouring, casting and inspection of finished fabricated/castings. - Inspection of finished castings for impeller and verification of materials. - Inspection of pump shaft and verification of material. - Witnessing of NDT/review of NDT reports. - Static balancing test for impeller and dynamic balancing of complete rotating parts as per ISO- 1940 to grade 6.3 or better. - Complete Inspection of assembled pump. <p>b) Hydraulic Testing</p> <p>The pump casing shall be hydrostatically tested at maximum of the following:</p> <ol style="list-style-type: none"> i. 2 times the TDH (Total Dynamic Head) at rated capacity (or) ii. 1.5 times the shut-off pressure (or) iii. System Design pressure indicated in Data Sheet-A of this section. <p>The HT pressure shall be maintained for a period of not less than 30 minutes. During testing there should not be any pressure drop & leakage.</p> <p>c) Performance Test at Shop</p> <p>i) Each pump shall have to be tested to determine the performance curves of the pumps. These tests are to be conducted in presence of Owner's representative as per the requirements of the Standards of Hydraulic Institute</p>	

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<p>of USA (ASME-Power Test Code PTC 8.2/BS-599) or any other equivalent standard.</p> <p>ii) Performance tests are to be conducted to cover the entire range of operation of the pumps at rated speed. These shall be carried out to span 130% of rated capacity up to pump shut-off condition. A minimum of five combinations of head and capacity are to be achieved during testing to establish the performance curves, including the design capacity point, shut-off point and the two extremities of the range of operation as specified in the annexure. After completion of performance test, all pumps shall be stripped down for inspection of internals.</p> <p>iii) Tests shall be conducted with actual drive motors being furnished.</p> <p>iv) NPSH tests are to be conducted for each type at 3% head drop conditions, if specified in the pump approved QP.</p> <p>v) 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.</p> <p>10.03.00 Inspection of Mandatory/ Recommended spares shall be in line with approved QP for main supply.</p> <p>11.00.00 DRAWINGS/ DOCUMENTS DISTRIBUTION SCHEDULE</p> <p>11.01.00 After award of LOI, the successful bidder shall submit drawings/documents as per Data Sheet-C.</p> <p>11.02.00 The no. of drawings/documents to be submitted shall be as per Annexure to Data Sheet-C.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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</p>			

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

14.00.00 Guarantee for all pumps shall at least remain valid for 18 months from the Unit commissioning date or as specified in NIT.

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

- a) Compliance certificate duly signed and stamped (enclosed at Vol. III of specn.).
- b) GA drawings of pumps and motors with following: (shall be only for reference purpose, same shall not be reviewed/commented by purchaser at this stage and shall be subject to approval only during contract).
 - Civil static & dynamic loads.
 - Foundation details.
- c) Guarantee Schedule duly signed and stamped (enclosed at Vol. III of specn.).
- d) Technical deviation schedule (if reqd.) (enclosed at Vol. III of specn.).
- e) Data for drive Motor (HT/LT- which is not in bidder's scope of supply - as applicable):
Load torque speed curves of the pumps, selected motor rating, rpm, GD² 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.

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1.01.00 The general guidelines as illustrated in the subsequent clauses of this section shall be applicable for vertical pumps to be procured under the scope of this package.

2.00.00 CODES AND STANDARDS

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

- | | | |
|---------|--|--|
| 2.01.01 | IS-1710/1989: | Vertical Turbine Pumps for Clear, Cold and Fresh Water. |
| 2.01.02 | IS-5120/1977: | Technical requirements for Rotodynamic special Purpose pumps. |
| 2.01.03 | IS-5639/1970: | Pumps for handling chemicals & corrosive liquids. |
| 2.01.04 | IS-5659/1970: | Pumps for process water. |
| 2.01.05 | IS-6536/1972: | Pumps for handling volatile liquids. |
| 2.01.06 | IS-9137/1978: | Code for acceptance tests for centrifugal, mixed flow and axial flow pumps- Class 'C'. |
| 2.01.07 | BS 5316 | Acceptance tests for Centrifugal, mixed flow Part-I/1976 and axial flow pumps - Class 'C' Tests (ISO 2548/1973) |
| 2.01.08 | BS 5316 | Acceptance tests for Centrifugal, mixed flow Part-II/1977 and axial flow pumps - Class 'B' Tests (ISO 3555/1977) |
| 2.01.09 | ANSI B 73.2M 1984 | Vertical inline centrifugal pumps for chemical process |
| 2.01.10 | API-610/1989: | Centrifugal pumps for general refinery services. |
| 2.01.11 | HIS | Hydraulic Institute Standards, USA |
| 2.01.12 | PTC 8.2/1965: | Power Test Codes - Centrifugal pumps. |
| 2.01.13 | ASTM-1-165-55 | Standard Methods for Liquid Penetration Inspection. |
| 2.02.00 | In case of any contradiction with the above standards and annexure, the stipulations in the annexure shall prevail and shall be binding on the bidder. | |

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3.01.00 The miscellaneous pumps and drives scope shall be as specified in Data Sheet A /Section A.

3.02.00 The Capacity, Head, Materials of construction and other particulars of pumps are detailed in Data Sheet-A of the specification.

3.03.00 Accessories:

All the pumps under this specification shall be complete with following standard/special accessories.

3.03.01 Standard accessories:

- a) LT Electric drives/motors (as applicable) with cable gland and lugs at motor end. (The bare HT drive motors and LT motors not in bidder's scope of supply, wherever required supplied as free issue by BHEL refer Cl. 5.08.00).
- b) Pump motor coupling along with coupling guard.
- c) Common base/sole plate for pumps and motor.
- d) Thrust block assembly (Thrust pads, attachments) for transferring the pump thrust to concrete thrust block (concrete thrust block in purchaser scope), as per clause 5.23.00.
- e) Thrust bearing temp. measurement devise to be provided.
- f) Self contained lubrication system along with all internal piping, valves, fittings, specialties etc. as required.
- g) Counter flanges for suction/ discharge nozzles along with fixing nuts, bolts and gaskets.
- h) Anchor bolts, nuts, seating steel works, shims etc. as necessary for mounting the pump-motor unit on Civil foundations.
- i) Suitable vent (with valves)/ lifting/ handling attachments for the pump/ motor/ accessories.
- j) Suitable drain connections with isolating valves as applicable.
- k) Supply of first fill of lubricants with topping requirements for one year of operation after commissioning and handing over of equipment.
- l) Set of "Special" Tools & Tackles for Pumps and motors, if any.



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- m) Erection and commissioning spares, "on as required" basis.
- n) Bidder shall provide various drawings, data, calculations, test reports/ certificates, operation and maintenance manuals, As-built drawings, etc. as specified and as necessary.
- o) Mandatory spares as specified in respective Data Sheet-A of this section.

3.04.00 Services included in Bidder's Scope:

3.04.01 The pumps shall be guaranteed to meet the performance requirements specified vide Data Sheet -A and also for trouble free operation after commissioning. Schedule of performance guarantees (enclosed in Volume-III) duly filled and signed shall be furnished with the bid.

3.04.02 The pumps erected by the purchaser shall be checked by the bidder for correctness of their installation, alignment, etc. at site prior to their commissioning.

3.04.03 After commissioning of pumps at site, site performance test for Noise, vibration and parallel running of pumps of all pumps for each unit/project will be conducted by BHEL at project site to ensure that the pumps meet the specified requirements. In case of any deficiency, the vendor shall rectify the same at site at no additional cost to BHEL.

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

3.05.00 Works excluded from Bidder's Scope:

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

4.00.00 **BID EVALUATION CRITERIA & LIQUIDATED DAMAGES FOR SHORTFALL:**

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

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

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



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

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

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

NOTE:

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

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

4.03.00 Liquidated damages for shortfall in Guaranteed KW

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


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

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

5.00.00 TECHNICAL REQUIREMENTS:

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

5.02.00 The pumps shall be Electric motor driven.

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5.03.00	The Pumps shall conform to HIS. It is bare minimum requirement, however, any other equivalent or stringent standard is also acceptable, if, all the requirements are also met.
5.04.00	<p>The type of Vertical pumps shall be as follows (if specifically not indicated otherwise in Data Sheet-A) :</p> <p>a) Vertical turbine type pumps with 1500rpm. (if no. of stages ≤ 5) shall be preferred.</p> <p>b) If stages of vertical turbine pumps are more than 5, then sump pump construction shall be preferred with 1500 rpm speeds.</p>
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	<p>The shut off head of pumps shall be more than pump rated TDH and percentage variation may vary depending on the specific speed of the pump as under:</p> <p>i. 10-15% for pumps of specific speed up to 1000 US units,</p> <p>ii. 15-20% for pumps of specific speed in the range of 1000 to 2000 US units,</p> <p>iii. 20-40% for pumps of specific speed in the range of 2000 to 4000 US units,</p> <p>iv. Above 50% for pumps of specific speed in the range of 4000 to 7000 US units.</p>
5.08.00	<p>All HT motors and those LT motors which are not in bidder's scope of supply : bare motors only, shall be supplied as free issue by BHEL through BHEL, based on ratings and TS (Torque - Speed) curve selected and furnished by the bidders along with their un-priced bid. The responsibility for satisfactory operation for combined performance of pumps & motors shall rest with the bidder only as if, the drive motors also have been supplied by the bidder..</p> <p>Couplings, base plate, foundation bolts, any other fittings, etc. as required shall be supplied by the bidders only. BHEL shall supply one number of each type of drive motors (where drive motor is not in bidder's scope of supply) for shop testing of pumps with job motors. All other motors shall be dispatched by BHEL directly to project sites.</p>
5.09.00	<p>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:</p> <ul style="list-style-type: none">• Purchaser's probes in both DE/NDE bearings of pumps• Key slots on pump shaft with dimensions as specified in Data Sheet A.• Other components as finalized during detailing.• For mounting of above on the HT motors, same shall be taken care by BHEL - Bhopal.
5.10.00	The pumps shall be capable of developing the required total head at rated capacity for continuous operation. The pumps shall operate satisfactorily at any point on the Q-H characteristic curve over a range of 0% to 130% capacity and shall be suitable for continuous operation between 30% to 130% capacity.



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- 5.11.00 Selection of the pumps shall be such that the design point shall be met even with negative manufacturing tolerance.
- 5.12.00 The total head capacity curve shall be continuously rising towards the shut off, the pumps shall preferably be non-overloading type and stable.
- 5.13.00 The pumps shall be capable of running over the entire range of submergence/ NPSH requirement conditions required without any noise, vibration or cavitations.
- The prevailing suction pressures for various pumps are indicated in Data Sheet-A for suitable mechanical design of pumps.
- 5.14.00 The pumps shall be of stiff shaft design. The minimum internal clearances should be sufficiently more than the max. static deflection of the shaft. Shaft size selected must take into consideration the critical speed as specified in API-610.
- 5.15.00 Pumps and motors shall run smooth without undue noise and vibration.
- The vibration shall be within vibration norms for testing as per American National Standard for 'Rotodynamics Pump' for Vibration Measurement and allowable values, Doc. ANSI/ HIS 9.6.4-2009. The applicable vibration limits for each pump, shall be indicated in the Technical Data sheet to be furnished by the successful bidder after award of LOI/ PO.
- The noise level shall be limited to 85 dB at distance of 1.0M.
- 5.16.00 Pumps of a particular category shall be identical and shall be suitable for parallel operation with equal load division. Components of identical pumps shall be interchangeable.
- 5.17.00 After installation, the guaranteed values of noise, vibration and parallel operation of pumps shall be tested and verified. If the site performance is found not meeting the requirements in any respect as specified, then the equipment shall be rectified or replaced by the vendor, at his own cost.
- 5.18.00 High reliability of the pumps is an essential requirement and therefore it gets weightage over its efficiency. It is therefore essential that the bidder choose a standard proven model from the range of pumps manufactured.
- 5.19.00 The offered pumps shall be of proven design meeting the experience-qualifying requirement of their operation at two sites for a minimum period of two years. Any deviation to this criterion shall be suitably highlighted in the deviations schedule.
- 5.20.00 The bearings shall be self-water lubricated, no external water supply shall be available. The cooling/ lubrication water for bearings, etc. shall be tapped from the pump discharge and supplied thru' bidder's integral pipe work.

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5.21.00 If water handled by pump is sea water/ dirty/ not suitable for lubrication/ cooling:

5.21.01 The bearing lubrication/cooling may be specifically reviewed by bidders for the suitability with water analysis enclosed with Data Sheet-A of this section.

These pumps shall necessarily be provided with Thordan type line shaft bearings even if the other type of bearings are claimed suitable by the manufacturers.

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

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

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

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



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- Instrumentation – Level Gauge, high level & low level switches for tank, pressure gauges at suction & discharge of each lubricating water pumps, low pressure switch on lubricating pipe at inlet to each of subject pump for subject pump start interlock, pressure switch on lubricating pipe at common discharge of subject pump for start up of stand by pump etc., as required subject to purchaser's approval shall be provided.
- Bidder shall supply any other equipment/ instrument required for proper functioning of the lubricating system, as deemed necessary during contract without any price implication to BHEL.
- Bidder shall also provide a relay based local control panel for proper functioning of the above system. The system shall be suitable for fully automatic operation as per approved write-up during detailed stage.
- Subject pumps shall be provided with shaft enclosing tube in the event above Lubrication system is envisaged by bidder. MOC for shaft enclosing tube shall be equivalent/ superior to MOC for column pipe for subject pump.

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

5.22.00 For Vertical pumps no thrust block is being provided except for pumps of projects, specified in Sec-C1 of this specification. Bidder to design the pump foundation system (base plate/ sole plate, discharge head, foundation bolts etc.) capable of transferring the pump thrust to the concrete pump foundation itself.

5.23.00 If specified in Sec-C1 of specification, thrust block assembly (Thrust pads, attachments) for transferring the pump thrust to concrete thrust block (concrete thrust block in purchaser scope) to be provided by bidder.

6.00.00 MANDATORY SPARES:

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

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

7.00.00 OTHER REQUIREMENTS:

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



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8.02.00 Pump(s) shall preferably be designed to have the best efficiency at flow within $\pm 10\%$ of the specified duty point flow. The pumps shall be suitable for continuous operation at any point within the "Range of Operation" as stipulated in the Data Sheet - A attached with this section.

8.03.00 Pump(s) shall preferably have a continuously rising head-capacity characteristics from the specified duty point towards shut-off point, the maximum being at shut-off to enable parallel operation.

Under all circumstances, the 'range of operation' of the pumps shall exclude any unstable operating zone of the head-capacity curve.

8.04.00 Wherever specified in the Data Sheet - A attached to this section, pumps of each category shall be suitable for parallel operation. The head vs. capacity, the BHP vs. capacity characteristics etc. shall be identical to ensure equal load sharing and trouble-free operation of any pump when the other pump(s) working in parallel with it trip.

8.05.00 The pump set along with drive motor shall run smooth without undue noise and vibration. Acceptable vibration limits shall be guided by the HIS of USA. Refer clause 5.15.00 above for permissible limits.

9.00.00 **DESIGN AND CONSTRUCTION**

Pumps shall be of vertical shaft, complete with bowl, column pipe, discharge head and base plate with all accessories. General design and constructional features of the pumps shall be as follows:

9.01.00 **Bowl Assembly**

9.01.01 This will be either a single or multi-stage centrifugal, mixed flow or axial flow type with discharge co-axial with shaft. Type of impeller shall be chosen on the basis of the pump specific speed and the characteristics of handling fluid.

9.01.02 Pumps (s) shall have provision for adjustment of impellers in vertical direction from an accessible location, preferably at the housing (where separate thrust bearing for the pump is provided). The adjustment mechanism must take into consideration the extension of the line shaft due to hydraulic down thrust, weight of the shaft and impeller.

9.02.00 **Discharge Head**

9.02.01 Pump (s) shall have above/below floor discharge, as specified in the Data Sheet-A, attached to this section.

9.03.00 **Column pipe**

9.03.01 Column pipe shall be flanged and of bolted connection. Column pipes shall be designed



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for full internal vacuum.

9.03.02 In case of multi-piece column pipe and shaft assembly, the design shall permit raising/lowering of the pump assembly piece by piece without any difficulty. Any fixtures, clamps, etc. necessary for such purpose shall be supplied by the Bidder under this section.

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

9.04.00 **Impeller shaft, line shaft and head shaft**

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

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

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

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

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

9.05.00 **Shaft enclosing tube**

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

9.06.00 **Seal rings**

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

9.07.00 **Bearings**

9.07.01 **Shaft bearings**

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

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

9.07.02 Thrust Bearing

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

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

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

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

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

9.08.00 Reverse Rotation

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

9.09.00 Drive Unit

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

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

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



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b) 5% margin over the maximum pump shaft input power required within the 'Range of Operation'.

c) Pump shaft input power required considering the overloading of the pump assuming single pump operation in the event of tripping of one or more of the pumps operating in parallel.

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

10.00.00 **INSPECTION AND TESTING**

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

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

a) **Identification and Testing**

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

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

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

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



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- The entire surface of the impeller / casing / diffuser castings shall be subjected to Dye Penetration Test as per ASTM Specification no.:1-165-65.
- Shaft coupling & other active components shall be subjected to Dye Penetration and Ultrasonic Tests.
- Wearing rings, shaft sleeves shall be subjected to Dye Penetration Test.
- Fabricated components of pumps shall be subjected to Dye Penetration test on weld.
- Verification of material, witnessing of pouring, casting and inspection of finished fabricated/castings.
- Inspection of finished castings for impeller and verification of materials.
- Inspection of pump shaft and verification of material.
- Witnessing of NDT/review of NDT reports.
- Static balancing test for impeller and dynamic balancing of complete rotating parts as per ISO- 1940 to grade 6.3 or better.
- Complete Inspection of assembled pump.

b) Hydraulic Testing

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

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

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

c) Performance Test at Shop

- i) Each pump shall have to be tested to determine the performance curves of the pumps. These tests are to be conducted in presence of Owner's representative as per the requirements of the Standards of Hydraulic Institute of USA (ASME-Power Test Code PTC 8.2/BS-599) or any other equivalent standard.
- ii) Performance tests are to be conducted to cover the entire range of operation of the pumps at rated speed. These shall be carried out to span 130% of rated



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capacity up to pump shut-off condition. A minimum of five combinations of head and capacity are to be achieved during testing to establish the performance curves, including the design capacity point, shut-off point and the two extremities of the range of operation as specified in the annexure. After completion of performance test, all pumps shall be stripped down for inspection of internals.

- iii) Tests shall be conducted with actual drive motors being furnished.
- iv) Minimum submergence/ NPSH required tests are to be conducted for each type at 3% head drop conditions, if specified in the pump approved QP.
- v) All rotating components of the pumps shall be subjected to static and dynamic balancing tests. The assembled rotor will be subjected to dynamic balancing tests.
- vi) Mechanical run test shall be carried out on all pumps to determine the vibration levels, noise levels etc. This test shall be conducted at site also. However, test value at site shall be used for the acceptance of the equipment.

10.03.00 Inspection of Mandatory/ Recommended spares shall be in line with approved QP for main supply.

11.00.00 DRAWINGS/ DOCUMENTS DISTRIBUTION SCHEDULE

11.01.00 After award of LOI, the successful bidder shall submit drawings/documents as per Data Sheet-C.

11.02.00 The no. of drawings/documents to be submitted shall be as per Annexure to Data Sheet-C.

12.00.00 The various Sections-C's & D's along with Data Sheets attached in this specification together with the specification for Miscellaneous Pumps shall be complied with by the bidders.

13.00.00 Bidder to submit all drawing/ documents in soft as well as hard copy within 2 weeks from placement of LOI's in the event of order.

Within one (1) week of receipt of BHEL comments a technical representative from Bidder's works shall come for meeting with BHEL along with revised documents to resolve all issues and incorporate all comments in the soft copy here only for further submission to customer.

Further on receipt of customer's comments on the documents a technical representative from Bidder's works shall come for meeting with Customer to resolve all issues and incorporate all comments in the soft copy here only and further resubmission of same to

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

14.00.00 Guarantee for all pumps shall at least remain valid for 18 months from the Unit commissioning date or as specified in NIT.

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

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

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

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PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage- V, Unit # 7 & 8 at Suratgarh, Rajasthan WATER SYSTEMS	SHEET 22 OF 23

ANNEXURE –1

RAW WATER ANALYSIS

Water samples are yet to be analysed in order to arrive at design quality.
However, the following shall be considered for this enquiry

SL. NO.	Constituent	Unit	Value
1.	P ^H	-	8.5
2.	Color and odor		
3.	Oil and grease	mg/l	DN
4.	BOD		3
5.	COD		20
6.	Suspended solids	mg/l	200
7.	Turbidity	NTU	200
8.	Calcium hardness as CaCO ₃	mg/l	74
9.	Magnesium hardness as CaCO ₃	mg/l	52
10.	Sodium as Na	mg/l	61
11.	Potassium as CaCO ₃	mg/l	-
12.	Chloride as cl	mg/l	39
13.	Sulphate as So ₄	mg/l	48
14.	Sulphide as S	Mg/l	-
15.	M- Alkalinity as CaCO ₃	mg/l	140
16.	P-Alkalinity as CaCO ₃	mg/l	Nil
17.	Nitrates as No ₃	mg/l	17
18.	Nitrites as NO ₂	mg/l	Nil
19.	Silica as SiO ₂ – Dissolved	mg/l	15
20.	Silica as SiO ₂ – Colloidal	mg/l	0.6
21.	Iron as CaCo3-dissolved	mg/l	0.5
22.	Iron as Fe-suspended	mg/l	0.1
23.	Total dissolved solids	mg/l	393

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R1

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24.	Conductivity at 25 ⁰ C	μ-mho/cm	500
25.	Dissolved Oxygen as O ₂	mg/l	5.0
26.	Carbon dioxide free	mg/l	5

1. The analysis given above shall be utilised for Bidding Purpose Only.
2. For design raw water analysis, the successful Contractor shall conduct physical & chemical tests to estimate the quality of raw water.
3. Should there be any change in the design raw water quality (based on physical & chemical tests, carried out by the successful contractor) from the analysis given above, the CONTRACTOR shall provide necessary alterations in the pre treatment & DM plant designs without any commercial implications.

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CLARIFIED WATER ANALYSIS

SL. NO.	Constituent	Unit	Value
1.	pH	-	8.5
2.	Color and Odor		
3.	Oil and grease	mg/l	ND
4.	BOD		3
5.	COD		20
6.	Suspended solids	mg/l	<15
7.	Turbidity	NTU	<15
8.	Calcium hardness as CaCO ₃	mg/l	74
9.	Magnesium hardness as CaCO ₃	mg/l	52
10.	Sodium as Na	mg/l	61
11.	Potassium	mg/l	-
12.	Chloride as cl	mg/l	39
13.	Sulphate as So ₄	mg/l	48
14.	Sulphide	mg/l	-
15.	M- Alkalinity as CaCO ₃	mg/l	140
16.	P-Alkalinity as CaCO ₃	mg/l	Nil
17.	Nitrates as No ₃	mg/l	17
18.	Nitrite	mg/l	Nil
19.	Silica as SiO ₂ – Dissolved	mg/l	15
20.	Silica as SiO ₂ – Colloidal	mg/l	0.6
21.	Iron as Fe-dissolved	mg/l	0.5
22.	Iron as Fe-suspended	mg/l	0.1
23.	Total dissolved solids	mg/l	393
24.	Conductivity at 250C	-mho/cm	500
25.	Dissolved Oxygen as O ₂	mg/l	5.0
26.	Carbon dioxide free	mg/l	5


Blow Down Water Analysis

SL. NO.	Constituent	Unit	Blow Down Water Value after COC 5 (Max.)
1	pH	-	8.5
2	Color and Odor		
3	Oil and grease	mg/l	ND
4	BOD		15
5	COD		100
6	Suspended solids	mg/l	75
7	Turbidity	NTU	75
8	Calcium hardness as CaCO ₃	mg/l	370
9	Magnesium hardness as CaCO ₃	mg/l	260
10	Sodium as Na	mg/l	305
11	Potassium	mg/l	-
12	Chloride as cl	mg/l	195
13	Sulphate as So ₄	mg/l	240
14	Sulphide	mg/l	-
15	M- Alkalinity as CaCO ₃	mg/l	700
16	P-Alkalinity as CaCO ₃	mg/l	Nil
17	Nitrates as No ₃	mg/l	85
18	Nitrite	mg/l	Nil
19	Silica as SiO ₂ – Dissolved	mg/l	75
20	Silica as SiO ₂ – Colloidal	mg/l	3
21	Iron as Fe-dissolved	mg/l	2.5
22	Iron as Fe-suspended	mg/l	0.5
23	Total dissolved solids	mg/l	1965
24	Conductivity at 250C	-mho/cm	2500
25	Dissolved Oxygen as O ₂	mg/l	25
26	Carbon dioxide free	mg/l	25


WATER ANALYSIS FOR DM WATER


Sl. No.	Characteristics	Value
1.	Silica (MAX.)	0.02 ppm as SiO ₂
2.	Iron as Fe	Nil
3.	Total Hardness	Nil
4.	pH Value	6.8-7.2
5.	Conductivity	Not more than 0.1 micro mhos / cm excluding the effects of free CO ₂


pH for passivated DM water shall be 8.5 to 9.5

	DATA SHEET - A							SPECIFICATION NO.:	PE-TS-392-100-N002
	MISCELLANEOUS PUMPS (HORIZONTAL)							REV. NO.: 00	DATE : 20/11/2013
	2 X 660 MW SURATGARH STPS UNIT 7 & 8							VOLUME : II B	SECTION : D
PROJECT/PACKAGE		2 X 660 MW SURATGARH STPS UNIT 7 & 8							
Sl. No.	DESCRIPTION	DMCW TG AUX'S PUMPS	DMCW SG AUX'S PUMPS	APH/ESP WASH PUMPS	CHP MAKE UP PUMPS	AHP MAKE UP PUMPS	DM MAKE UP PUMPS	HOTWELL MAKE UP PUMPS	BOILER FILL PUMPS
		HORIZONTAL PUMPS (GROUP-I)							
1.0	SERVICE								
1.1	Total no. of pumps for Project	6	4	2	2	3	2	4	2
1.2	No. of working & standby pumps	(2+1) per unit	(1+1) per unit	(1+1) for station	(1+1) for station	(2+1) for station	(1+1) for station	(2+2) for station	(1+1) for station
1.3	Liquid Handled (ref. water analysis enclosed herein)	PH corrected DM Water	PH corrected DM Water	Blowdown water	Blowdown water	Blowdown water	DM Water	DM Water	DM Water
1.4	Location (Indoor / Outdoor)	Indoor	Indoor	Indoor	Indoor	Indoor	Outdoor	Indoor	Indoor
1.5	Duty	Continuous	Continuous	Intermittent	Continuous	Continuous	Continuous	Continuous	Intermittent
1.6	No. of pumps working in parallel	2	-	-	-	2	-	2	-
1.7	Specific gravity	1	1	1	1	1	1	1	1
1.8	System design pressure (kg/sqcm)	10	12	12	10	10	10	10	25
2.0	DESIGN PARAMETERS								
2.1	Design capacity each, M ³ /hr	1050	800	750	325	850	85	130	200
2.2	Total dynamic head (MWC)	38	57	82	35	18	60	65	175
2.3	Suction Pressure(MWC)	25.5	25.5	Flooded suction	Flooded suction	Flooded suction	Flooded suction	Flooded suction	Flooded suction
2.4	Design Temperature (°C)	60	60	60	60	60	60	60	60
2.5	Maximum permissible speed of pump (RPM)	1500	1500	3000	1500	1500	3000	1500	3000
2.6	Max. limit on shut off head Corresponding to pump TDH (MWC) at 52.5 Hz	Not to exceed 65 MWC	Not to exceed 85 MWC	Not to exceed 110 MWC	Not to exceed 70 MWC	Not to exceed 70 MWC	-	-	-
2.7	Operating range	-----30-130% of design duty point flow-----							
2.8	Motor rating	Motor rating (at 50 deg. C ambient) shall be either above the power requirement at any condition of the entire characteristic curve of the pump (viz. 0-130%) or 16% extra of the power required at the design point, whichever is maximum.							
2.9	Permissible tolerance in rated capacity & TDH	no negative tolerance							
2.10	Permissible tolerance in efficiency at rated capacity(%)	no negative tolerance							
2.11	Performance/Design Standard	HIS							
3.0	CONSTRUCTION FEATURES								
3.1	Pump type	Horizontal centrifugal type Between Bearing Pump	Horizontal centrifugal type Between Bearing Pump	Horizontal centrifugal type Between Bearing Pump	Horizontal centrifugal type Between Bearing Pump	Horizontal centrifugal type Between Bearing Pump	Horizontal centrifugal type Between Bearing Pump	Horizontal centrifugal type Between Bearing Pump	Horizontal centrifugal type Between Bearing Pump
3.2	Impeller type	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
3.3	Casing type	Axial split type	Axial split type	Axial split type	Axial split type	Axial split type	Axial split type / Radial split type	Axial split type	Axial split/ Radial Split type
3.4	Coupling type	Flexible type	Flexible type	Flexible type	Flexible type	Flexible type	Flexible type	Flexible type	Flexible type
3.5	Sealing arrangement	Gland packing initially & Mechanical seal finally after commissioning	Gland packing initially & Mechanical seal finally after commissioning	Gland packing	Gland packing	Gland packing	Gland packing initially & Mechanical seal finally after commissioning	Gland packing initially & Mechanical seal finally after commissioning	Gland packing initially & Mechanical seal finally after commissioning
3.6	Type of Lubrication	Oil/ Grease/ Self Liquid	Oil/ Grease/ Self Liquid	Oil/ Grease/ Self Liquid	Oil/ Grease/ Self Liquid	Oil/ Grease/ Self Liquid	Oil/ Grease/ Self Liquid	Oil/ Grease/ Self Liquid	Oil/ Grease/ Self Liquid
3.7	Pump characteristics	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable
3.8	Drain Plugs, vent, lifting lugs, priming connection	Required							
4.0	MATERIALS OF CONSTRUCTION								
4.1	Casing	CI to IS 210 FG 260	CI to IS 210 FG 260	CI to IS 210 FG 260	CI to IS 210 FG 260	CI to IS 210 FG 260	SS 304	SS 304	SS 304
4.2	Impeller	SS 304	SS 304	SS 304	SS 304	SS 304	SS 304	SS 304	SS 304
4.3	Shaft	SS-410	SS-410	SS-410	SS-410	SS-410	SS 304	SS 304	SS 304
4.4	Shaft Sleeves	SS-410 (hardened)	SS-410 (hardened)	SS-410 (hardened)	SS-410 (hardened)	SS-410 (hardened)	SS-410	SS-410	SS-410
4.5	Impeller Wearing rings	SS 304	SS 304	SS 304	SS 304	SS 304	SS 304	SS 304	SS 304
4.6	Wetted fasteners	SS 304	SS 304	SS 304	SS 304	SS 304	SS 304	SS 304	SS 304
4.7	Fasteners (others)	High tensile Steel	High tensile Steel	High tensile Steel	High tensile Steel	High tensile Steel	High tensile Steel	High tensile Steel	High tensile Steel
4.8	Gland/Seal Cover	CI to IS 210 FG 260	CI to IS 210 FG 260	CI to IS 210 FG 260	CI to IS 210 FG 260	CI to IS 210 FG 260	SS-304	SS-304	SS-304
4.9	Lantern Ring	SS 304	SS 304	SS 304	SS 304	SS 304	SS 304	SS 304	SS 304
4.10	Mech. seal	Manufacturer standard	Manufacturer standard	NA	NA	NA	Manufacturer standard	Manufacturer standard	Manufacturer standard
4.11	Gland Packing	PTFE/ Grafoil	PTFE/ Grafoil	PTFE/ Grafoil	PTFE/ Grafoil	PTFE/ Grafoil	PTFE/ Grafoil	PTFE/ Grafoil	PTFE/ Grafoil
4.12	Base Plate	MS fabricated IS-2062 (min. thk.-10 mm) Epoxy Coated							
4.13	Stuffing Box	CI to IS 210 FG 260	CI to IS 210 FG 260	CI to IS 210 FG 260	CI to IS 210 FG 260	CI to IS 210 FG 260	SS 304	SS 304	SS 304
4.14	Casing Wearing rings (If applicable)	SS 304	SS 304	SS 304	SS 304	SS 304	SS 304	SS 304	SS 304
4.15	Connecting Pipe material (for deciding counterflange material)	Carbon Steel as per IS:2062, Plates rolled & welded as per IS 3589	Carbon Steel as per IS:2062, Plates rolled & welded as per IS 3589	Carbon Steel as per IS:2062, Plates rolled & welded as per IS 3589	Carbon Steel as per IS:2062, Plates rolled & welded as per IS 3589	Carbon Steel as per IS:2062, Plates rolled & welded as per IS 3589	SA 312 TP 304 (stainless steel)	SA 312 TP 304 (stainless steel)	SA 312 TP 304 (stainless steel)
5.0	MANDATORY SPARES								
	Pumps								
5.1	All gaskets in one Pump	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set
5.2	All O Rings in one pump	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set
5.3	Gland packing in one Pump	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set
5.4	Impeller	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.
5.5	All Pump bearings in One pump	2 sets	2 sets	2 sets	2 sets	2 sets	2 sets	2 sets	2 sets
5.6	Shaft	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.
5.7	Impeller Lock Nut	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set
5.8	Shaft protection sleeve	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set
5.9	Pump Motor Coupling Complete	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set
5.10	All wearing rings in one pump	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set
5.11	Mechanical Seal	1 set	1 set	NA	NA	NA	1 set	1 set	1 set
5.12	Coupling pad/ Bushing	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set



	DATA SHEET - A							SPECIFICATION NO.:	PE-TS-392-100-N002	
	MISCELLANEOUS PUMPS (HORIZONTAL)							REV. NO.: 00	DATE : 20/11/2013	
		2 X 660 MW SURATGARH STPS UNIT 7 & 8							VOLUME : II B	SECTION : D
	PROJECT/PACKAGE		2 X 660 MW SURATGARH STPS UNIT 7 & 8							
Sl. No.	DESCRIPTION	DMCW TG AUX'S PUMPS	DMCW SG AUX'S PUMPS	APH/ESP WASH PUMPS	CHP MAKE UP PUMPS	AHP MAKE UP PUMPS	DM MAKE UP PUMPS	HOTWELL MAKE UP PUMPS	BOILER FILL PUMPS	
	Motors									
5.11	Motor of each type & rating	N.A.	N.A.	N.A.	1 No.	1 No.	1 No.	1 No.	1 No.	
5.12	Motor Bearings	N.A.	N.A.	N.A.	2 Sets	2 Sets	2 Sets	2 Sets	2 Sets	
5.13	Space Heater (If applicable)	N.A.	N.A.	N.A.	1 No.	1 No.	1 No.	1 No.	1 No.	
5.14	Motor cooling fan	N.A.	N.A.	N.A.	3 Nos.	3 Nos.	3 Nos.	3 Nos.	3 Nos.	
6.0	BID EVALUATION RATE									
6.1	Bid evaluation rate	Rs.3 Lacs/KW	Rs.3 Lacs/KW	NA	Rs.3 Lacs/KW	Rs.3 Lacs/KW	Rs.3 Lacs/KW	Rs.3 Lacs/KW	NA	
6.2	Maximum permissible efficiency for Bid evaluation									
6.2.1	Pump Efficiency	86	84	-	82	86	65	82	-	
6.2.2	Motor Efficiency	93	93	-	94	95	94	94	-	
Notes :										
1	Material of construction for other components not specified above shall be similarly selected in line with the above for the duty intended and subject to approval.									
2	For items stated as not applicable by bidder, shall have to be supplied without any cost implication to BHEL in the event they are found to be applicable during detail engineering stage.									
3	For all HT motor driven pumps (wherever applicable), bidder shall provide key slots of dimensions 30mm Lx15 mm W x3 mmD on each pump shaft or some other suitable location which shall be confirmed during detail engineering by BHEL.									
4	Wherever SS material is coming in contact with non SS material, suitable isolation (rubber etc.) shall be provided to avoid galvanic corrosion.									

	DATA SHEET - A					SPECIFICATION NO.: PE-TS-392-100-N002			
MISCELLANEOUS PUMPS (Vertical Pumps)						REV. NO.: 00		DATE : 20.11.2013	
2 X 660 MW SURATGARH STPS UNIT 7 & 8						VOLUME : II B		SECTION D	
Sl. No.	DESCRIPTION	ACW Pumps	River/ Raw Water Intake Pumps	Raw Water Pumps	Ash Water Make up Pumps	Plant Potable/ Filtered Water Pumps	AHP Seal Water Pumps	CW Make Up Pumps	Plant Service Water Pumps
VERTICAL PUMPS(GROUP-II)									
1.0	SERVICE								
1.1	Total no. of pumps for Project	5	5	3	3	2	2	3	2
1.2	No. of working & standby pumps	(2W per unit) +1 common Standby	(4W+1S) for station	(2W+1S) for station	(2W+1S) for station	(1W+1S) for station	(1W+1S) for station	(2W+1S) for station	(1W+1S) for station
1.3	Liquid Handled (ref. water analysis enclosed herein)	Clarified Water	Raw Water	Raw Water	Raw Water	Clarified water	Clarified water	Clarified water	Clarified water
1.4	Location	CW/ACW P/H	River water Intake P/H	Raw Water P/H		Filtered Water P/H			
1.4.1	Indoor / Outdoor	Indoor	Indoor	Indoor	Indoor	Indoor	Indoor	Indoor	Indoor
1.5	Duty	Continuous	Continuous	Continuous	Continuous	Intermittent	Continuous	Continuous	Intermittent
1.6	Specific gravity	1	1	1	1	1	1	1	1
1.7	No. of pumps working in parallel	2	4	2	2	-	-	2	-
1.8	System design pressure (kg/sqcm)	7.5	10	10	10	10	10	10	15
2.0	DESIGN PARAMETERS								
2.1	Design capacity each, M³/hr	1550	2150	2050	375	25	150	1725	300
2.2	Total dynamic head (MWC) (At Bowl, excluding Pumps Internal frictional losses upto discharge)	40	50	30	30	53	30	16	91
2.3	• Suction Pressure(MWC)	Submerged Suction	Submerged Suction	Submerged Suction	Submerged Suction	Submerged Suction	Submerged Suction	Submerged Suction	Submerged Suction
	• Floor Level- for Pump Mounting	(+) 2.2 M	RL (+) 189.0 M	RL (+) 194.5 M	RL (+) 194.5 M	(+) 0.0 M	(+) 0.0 M	(+) 0.0 M	(+) 0.0 M
	• Min. W.L	(-) 0.3 M	RL (+) 184.0 M	RL (+) 185.2 M	RL (+) 185.2 M	(-) 5.0 M	(-) 5.0 M	(-) 5.0 M	(-) 5.0 M
	• Max. W.L.	(+) 0.7M	RL (+) 187.6 M	RL (+) 193.5 M	RL (+) 193.5 M	(-) 1.5 M	(-) 1.5 M	(-) 1.5 M	(-) 1.5 M
	• Sump Invert Level	(-) 2.4 M	RL (+) 181.0 M	RL (+) 182.7 M	RL (+) 182.7 M	(-) 7.5 M	(-) 7.5 M	(-) 7.5 M	(-) 7.5 M
	• Crane Hook Level	(+) 15.15 M	RL (+) 194.0 M	RL (+) 199.5 M	RL (+) 199.5 M	(+) 5.0 M	(+) 5.0 M	(+) 5.0 M	(+) 5.0 M
	• Crane Capacity Available	40 Ton	5 Ton	5 Ton	5 Ton	5 Ton	5 Ton	5 Ton	5 Ton
2.4	Design Temperature (°C)	60	60	60	60	60	60	60	60
2.5	Maximum permissible speed of pump (RPM)	1500	1500	1500	1500	3000	1500	1500	1500
2.6	Max. limit on shut off head Corresponding to pump TDH (MWC) at 52.5 Hz	Not to exceed 70 MWC	Not to exceed 95 MWC	Not to exceed 95 MWC	Not to exceed 95 MWC	Not to exceed 95 MWC	Not to exceed 95 MWC	Not to exceed 95 MWC	Not to exceed 140 MWC
2.7	Pump Discharge - above floor / below floor	Above floor							
2.8	Discharge pipe (ODXTHK).(mmxmm)	508 X 8	610 X 8	610 X 8	273 X 6.3	115 x 5.4	219.1 X 6.3	508 X 8	273 X 6.3
2.9	Operating range	30-130% of design duty point flow							
2.10	Motor rating	Motor rating (at 50 deg. C ambient) shall be either above the power requirement at any condition of the entire characteristic curve of the pump (viz. 0-130%) or 16% extra of the power required at the design point, whichever is maximum.							
2.11	Permissible tolerance in rated capacity & TDH	no negative tolerance							
2.12	Permissible tolerance in efficiency at rated capacity(%)	no negative tolerance							
2.13	Performance/Design Standard	HIS							
3.0	CONSTRUCTION FEATURES								
3.1	Pump type	Vertical Turbine Type	Vertical Turbine Type	Vertical Turbine Type	Vertical Turbine Type	Vertical Turbine Type	Vertical Turbine Type	Vertical Turbine Type	Vertical Turbine Type
3.2	Impeller type	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
3.3	Casing type	Vertical turbine type							
3.4	Coupling type	Flexible	Flexible	Flexible	Flexible	Flexible	Flexible	Flexible	Flexible
3.5	Sealing arrangement	Self Water/Gland packing	Self Water/Gland packing	Self Water/Gland packing	Self Water/Gland packing	Self Water/Gland packing	Self Water/Gland packing	Self Water/Gland packing	Self Water/Gland packing
3.6	Type of Lubrication	Oil/ Grease/ Self Water	Oil/ Grease/ Self Water	Oil/ Grease/ Self Water	Oil/ Grease/ Self Water	Oil/ Grease/ Self Water	Oil/ Grease/ Self Water	Oil/ Grease/ Self Water	Oil/ Grease/ Self Water
3.7	Pump characteristics	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable
3.8	Drain Plugs, vent, lifting lugs, etc.	Required							
4.0	MATERIALS OF CONSTRUCTION								
4.1	Casing & Suction Bell	CI to IS 210 FG 260	CI to IS 210 FG 260	CI to IS 210 FG 260	CI to IS 210 FG 260	CI to IS 210 FG 260	CI to IS 210 FG 260	CI to IS 210 FG 260	CI to IS 210 FG 260
4.2	Column Pipe	MS FAB. IS-2062 Gr B epoxy coated	MS FAB. IS-2062 Gr B epoxy coated	MS FAB. IS-2062 Gr B epoxy coated	MS FAB. IS-2062 Gr B epoxy coated	MS FAB. IS-2062 Gr B epoxy coated	MS FAB. IS-2062 Gr B epoxy coated	MS FAB. IS-2062 Gr B epoxy coated	MS FAB. IS-2062 Gr B epoxy coated
4.3	Minimum column pipe thickness, mm	10 mm	10 mm	10 mm	8 mm	8 mm	8 mm	10 mm	8 mm
4.4	Impeller	ASTM -A351- CF8	ASTM -A351- CF8	ASTM -A351- CF8	ASTM -A351- CF8	ASTM -A351- CF8	ASTM -A351- CF8	ASTM -A351- CF8	ASTM -A351- CF8
4.5	Shaft/ Line Shaft	ASTM A 276 Type 410	ASTM A 276 Type 410	ASTM A 276 Type 410	ASTM A 276 Type 410	ASTM A 276 Type 410	ASTM A 276 Type 410	ASTM A 276 Type 410	ASTM A 276 Type 410
4.6	Shaft Sleeves	ASTM A 276 Type 410 Hardened	ASTM A 276 Type 410 Hardened	ASTM A 276 Type 410 Hardened	ASTM A 276 Type 410 Hardened	ASTM A 276 Type 410 Hardened	ASTM A 276 Type 410 Hardened	ASTM A 276 Type 410 Hardened	ASTM A 276 Type 410 Hardened
4.7	Shaft Coupling	ASTM A 276 Type 410	ASTM A 276 Type 410	ASTM A 276 Type 410	ASTM A 276 Type 410	ASTM A 276 Type 410	ASTM A 276 Type 410	ASTM A 276 Type 410	ASTM A 276 Type 410
4.8	Wearing rings	ASTM -A351- CF8	ASTM -A351- CF8	ASTM -A351- CF8	ASTM -A351- CF8	ASTM -A351- CF8	ASTM -A351- CF8	ASTM -A351- CF8	ASTM -A351- CF8
4.9	Wetted fasteners	ASTM A 193/ 194- B8M/8M	ASTM A 193/ 194- B8M/8M	ASTM A 193/ 194- B8M/8M	ASTM A 193/ 194- B8M/8M	ASTM A 193/ 194- B8M/8M	ASTM A 193/ 194- B8M/8M	ASTM A 193/ 194- B8M/8M	ASTM A 193/ 194- B8M/8M
4.10	Fasteners (others)	ASTM A 193/ 194- B8M/8M	ASTM A 193/ 194- B8M/8M	ASTM A 193/ 194- B8M/8M	ASTM A 193/ 194- B8M/8M	ASTM A 193/ 194- B8M/8M	ASTM A 193/ 194- B8M/8M	ASTM A 193/ 194- B8M/8M	ASTM A 193/ 194- B8M/8M
4.11	Gland plate	CI to IS 210 FG 260	CI to IS 210 FG 260	CI to IS 210 FG 260	CI to IS 210 FG 260	CI to IS 210 FG 260	CI to IS 210 FG 260	CI to IS 210 FG 260	CI to IS 210 FG 260
4.12	Lantern Ring	SS 304	SS-304	SS-304	SS-304	SS-304	SS-304	SS-304	SS-304
4.13	Intermediate stage bearings	Cutless Nitrile rubber in SS Shell	Cutless Nitrile rubber in SS Shell	Cutless Nitrile rubber in SS Shell	Cutless Nitrile rubber in SS Shell	Cutless Nitrile rubber in SS Shell	Cutless Nitrile rubber in SS Shell	Cutless Nitrile rubber in SS Shell	Cutless Nitrile rubber in SS Shell
4.14	Mech. seal	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4.15	Gland Packing (Asbestos Free)	PTFE	PTFE	PTFE	PTFE	PTFE	PTFE	PTFE	PTFE
4.16	Base/ Sole Plate	Fabricated Steel to IS 2062 with epoxy coated (minimum 10 mm thickness)							
4.17	Connecting Pipe material (for deciding counterflange material)	Piping upto 150NB shall be Carbon Steel ERW, IS:1239 (Heavy Grade) and piping 150 NB and above shall be Carbon Steel (IS:2062), rolled and welded conforming to IS:3589.							
5.0	MANDATORY SPARES	Bidder to furnish the recommended spares list seperately for further ordering by customer.							
5.1	Pumps								
5.1.1	Bearings	2 sets	2 sets	2 sets	2 sets	2 sets	2 sets	2 sets	2 sets
5.1.2	Gland packing	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set
5.1.3	Couplings	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set
5.1.4	Coupling pads/ Bushings	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set

	DATA SHEET - A						SPECIFICATION NO.: PE-TS-392-100-N002		
	MISCELLANEOUS PUMPS (Vertical Pumps)						REV. NO.: 00		DATE : 20.11.2013
	2 X 660 MW SURATGARH STPS UNIT 7 & 8						VOLUME : II B	SECTION D	
Sl. No.	DESCRIPTION	ACW Pumps	River/ Raw Water Intake Pumps	Raw Water Pumps	Ash Water Make up Pumps	Plant Potable/ Filtered Water Pumps	AHP Seal Water Pumps	CW Make Up Pumps	Plant Service Water Pumps
5.2	Motors								
5.2.1	Motor of each type & rating	NA	NA	NA	1 No.	1 No.	1 No.	1 No.	1 No.
5.2.2	Motor Bearings	NA	NA	NA	1 Set	1 Set	1 Set	1 Set	1 Set
5.2.3	Space Heater (If Applicable)	NA	NA	NA	1 No.	1 No.	1 No.	1 No.	1 No.
5.2.4	Motor cooling fan	NA	NA	NA	3 Nos.	3 Nos.	3 Nos.	3 Nos.	3 Nos.
6.0	Bid Evaluation								
6.1	Bid evaluation rate	Rs. 3 Lacs/KW	Rs. 3 Lacs/KW	Rs. 3 Lacs/KW	Rs. 3 Lacs/KW	NA	Rs. 3 Lacs/KW	Rs. 3 Lacs/KW	NA
6.2	Maximum permissible efficiency for Bid evaluation								
6.2.1	Pump Efficiency	86	86	87	84	-	72	87	-
6.2.2	Motor Efficiency	93	93	93	94	-	94	95	-
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 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	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.								
4	Wherever SS material is coming in contact with non SS material, suitable isolation (rubber etc.) shall be provided to avoid galvanic corrosion.								



TECHNICAL SPECIFICATIONS MISCELLANEOUS PUMPS DATA SHEET - C	SPECN. NO.: PE-TS-MOU-100-N002			
	VOLUME:	IIB	SECTION:	D1
	REV. NO.	0	DATE:	30.07.12

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 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.
- 1.2 Cross sectional drawing of the equipment showing the details of assembly of components and their material of construction with standard applicable codes.
- 1.3 Characteristic curves of pump showing the following:
 - a) Flow Vs Head
 - b) Flow VS Power
 - c) Flow Vs Efficiency
 - d) Flow Vs NPSHR
- 1.4 Operation and maintenance manual
- 1.5 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 project:

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



BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN

Rev-01

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

NAME SIGN. DATE	Prepared By AJAY JAIN 23-07-2012	Reviewed By ASHWANI KHANNA 23-07-2012	Approved By I. J. SINGH 23-07-2012
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<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: left;"> </div> <div> BHARAT HEAVY ELECTRICALS LIMITED PROJECT ENGINEERING MANAGEMENT STANDARD QUALITY PLAN </div> <div style="text-align: right; border: 1px solid red; padding: 2px;"> Rev-01 </div> </div>															
QUALITY PLAN FOR MISCELLANEOUS PUMPS				CUSTOMER		PROJECT TITLE									
SHEET 2 OF 6				BIDDER/VENDOR		QUALITY PLAN NUMBER									
				SYSTEM		ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL)									
S. No.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE/METHOD OF CHECKED	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS			
									P	W	V				
1	2	3	4	5	6	7	8	9	10			11			
1.6	PLATE FLANGE, C/FLANGE	1. MECHANICAL & CHEMICAL PROS. 2. DIMENSIONS. 3. SURFACE FINISH	MA	1. MECH & CHEM TEST 2. MEASUREMENT 3. VISUAL EXAM	1/CAST 100% 100%	APPROVED GA DRG./DATA SHEET	RELEVANT MATERIAL SPECN./ MFR. DRG./ APPROVED DOC	MILL TC/ LAB REPORT	3/2.		2,1	CORRELATION REQ. FOR MAT OTHER THAN IS 2062			
1.7	SUCTION STRAINER (IF APPLICABLE)	MECHANICAL & CHEMICAL PROS.	MI	MECH. & CHEMICAL TEST	1/HEAT	APPROVED GA DRG./DATA SHEET	RELEVANT MATERIAL SPECN./ MFR. DRG./ APPROVED DOC	MILL TC/ LAB REPORT	3/2.		2,1				
1.8	MECHANICAL SEAL (IF APPLICABLE)	TYPE, SIZE, MFRS, NO., MAKE	MA	VISUAL EXAM	100%	APPROVED DATASHEET / GA MECH. SEAL	APPROVED DATASHEET		3/2.		2,1	COMPLIANCE TC FOR APPROVED MAKE			
1.9	PUMP BEARINGS	TYPE, SIZE, MFRS, NO., MAKE	MA	VISUAL EXAM	100%	APPROVED DATASHEET	APPROVED DATASHEET		3/2.		2,1	COMPLIANCE TC FOR APPROVED MAKE			
2.0 IN PROCESS CONTROL															
2.1	ALL COMPONENTS UNDER 1.00 ABOVE	VISUAL DEFECTS, DIMENSIONS	MA	VISUAL EXAM, MEASUREMENT	100%	MFG. DRAWING	MFG. DRAWING	COMPLIANCE TC	3/2.		2,1				
2.2	IMPELLER	CLEANING AND DEBURRING	MA	VISUAL	100%	MFG. DRAWING	MFG. DRAWING		3/2.		2,1				
	IMPELLER	DYNAMIC BALANCING	CR	DYNAMIC BALANCING	100%	ISO 1940	ISO1940 Gr 6.3	BALANCING CERTIFICATE	3/2.	2,1		WITNESSING ONLY FOR SIZE GREATER THAN 10KW			
2.3	IMPELLER-ALL ACCESSIBLE SURFACES, DIFFUSERS	DP TEST	MA	DP TEST ON M/CED AREA	100%	APPENDIX 8 OF ASME SEC. VIII DIV. 1	NDT CERTIFICATE		3/2.	2,1		WITNESS BY BHEL & VARIIFICATION BY CUSTOMER			
2.4	WERING RING, SHAFT SLEEVES, CASING	DP TEST	MA	DP TEST ON M/CED AREA	100%	APPENDIX 8 OF ASME SEC. VIII DIV. 1	NDT CERTIFICATE		3/2.		2,1				
2.5	SHAFT	DP TEST	MA	DP TEST ON M/CED AREA	100%	ASTM E 165	NO RELEVANT INDICATION ALLOWED	NDT CERTIFICATE	3/2.	2,1		WITNESS BY BHEL & VARIIFICATION BY CUSTOMER			
2.6	CASINGS/ BOWLS, STAGE BODIES, DISCHARGE HEAD (IF CAST), SUCTION HOUSING, COLUMN PIPE DISCHARGE PIPE ETC	LEAK TIGHTNESS	CR	VISUAL	100%	TECHNICAL DATA SHEET AND NOTE 2	NO LEAKAGE FOR TEST DURATION OF 30 MIN.	HT CERTIFICATE	3/2.	2,1		HAMMERING OF CASTINGS WITH WOODEN/ RUBBER MALLET BEFORE HYDRO TEST			
BHEL				PARTICULARS			BIDDER / VENDOR								
				NAME											
				SIGNATURE											
				DATE											
NAME SIGN. DATE				Prepared By AJAY JAIN 23-07-2012				Reviewed By ASHWANI KHANNA 23-07-2012				Approved By I. J. SINGH 23-07-2012			



BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN

Rev-01

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

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



BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN

Rev-01

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

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



BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN

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QUALITY PLAN FOR MISCELLANEOUS PUMPS				CUSTOMER		PROJECT TITLE						
				BIDDER/VENDOR		QUALITY PLAN NUMBER						
SHEET 5 OF 6				SYSTEM		ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL)						
S. No.	COMPONENT / OPERATION	CHARACTERISTIC CHECKED	CATEGORY	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
4	FINAL INSPECTION, TESTS & PACKING DESPATCH CONTROL											
4.1	PUMP WITH JOB/SHOP MOTOR ASSEMBLED ON INDIVIDUAL BASE FRAME	1. Q V/S HEAD, 2. Q V/S POWER, 3. Q V/S PUMP EFF. 4. VIBRATION 5. NOISE 6. BEARING TEMP. 7. LEAKAGES	CR	PERFORMANCE TEST	100%	APPD. PERFORMANCE TEST PROCEDURE/ APPD. DATA SHEET/APPD. CURVES FOR VIBRATIONS - AS PER ANSI/HIS 9.8.4-2009 (VALUES AS PER APPROVED DATA SHEET) FOR BEARING TEMP - BEARING HOUSING SHOULD NOT BE UNTOUCHABLY HOT. FOR LEAKAGE - MINOR LEAKAGE (DROP BY DROP) IN CASE OF GLAND PACKING ARRANGEMENT.		I.R., PERF. TEST RECORD, PLOTTED CURVES	3/2	2.1.		* MINIMUM 7 POINTS FROM SHUT-OFF TO MAX. OPERATING FLOW COVERING ENTIRE OPERATION RANGE OF PUMP SHALL BE TAKEN.
		NPSH/ MIN. SUBMERGENCE REQUIRED	CR	NPSH TEST	1/MODEL	DO.	IR. NPSH/MIN. SUBMERGENCE TEST RECORD, PLOTTED CURVES	3/2	2.1.		IF SPECIFIED or INSISTED BY CUSTOMER.	
4.2	STRIP DOWN AFTER PERFORMANCE TEST	1. UNDUE WEAR TEAR AND RUBBING	MA	VISUAL EXAM AFTER STRIPPING	1/MODEL	NO UNDUE WEAR TEAR & RUBBING ON IMPELLER & WEAR RING		INSP. REPORT	3/2	1		WITNESS REQUIRED ONLY WHEN ABNORMAL SOUND OBSERVED DURING PERFORMING TEST.
4.3	COMPLETE PUMP WITH UNIT MOTOR BASE FRAME, COUNTER FLANGES ETC. INCLUDING ALL ACCESSORIES AS PER SECTION C OF SPECN.	COMPLETENESS, CLEANLINESS, OVERALL DIMENSIONS ORIENTATION, WORKMANSHIP AND FINISH	MA	VISUAL EXAM MEASUREMENT	100%	APPD. G.A DRAWING	APPD. G.A DRAWING	INSP. REPORT	3/2	1		
BHEL			PARTICULARS			BIDDER / VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER/VENDOR SEAL			

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

Rev-01

QUALITY PLAN FOR MISCELLANEOUS PUMPS

CUSTOMER

PROJECT TITLE

BIDDER/VENDOR

QUALITY PLAN NUMBER

SHEET 6 OF 6

SYSTEM

ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL)

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

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

1.AS CAST HEAT MARKS SHALL BE PROVIDED ON CI CASTING LIKE TOP & BOTTOM CASING.

2. HYDRO TEST PRESSURE SHALL BE AT LEAST 2(TWO) TIMES THE DUTY POINT (OR) 1.5 TIMES OF SHUT OFF HEAD (OR) SYSTEM DESIGN PRESSURE, WHICHEVER IS HIGHER.

3. THIS QAP IS ALSO APPLICABLE FOR SPARES.

4. NO WELD REPAIRS PERMISSIBLE ON CI CASTING.

5. MATERIAL SHALL BE AS PER APPROVED CROSS SECTION DRG./ DATA SHEET.

6. STRIP TEST- INCASE OF ABNORMAL NOISE OBSERVED DURING PERF. TEST, THOSE PUMP WILL BE STRIPPED DOWN FOR VISUAL INSPECTION OF IMPELLER & WEAR SHALL BE OFFERED FOR VISUAL INSPECTION FOR WEAR /RUBBING MARKS.

7. PUMPS WITH MECHANICAL SEAL ARRANGEMENT TO BE TESTED AND SUPPLIED WITH GLAND PACKING ARRANGEMENT. HOWEVER MANUFACTURER TO ENSURE DIMENTIONAL MATCHING OF MECHANICAL SEAL WITH PUMP GA DRAWING.

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

P- PERFORM, W- WITNESS, V-VERIFICATION


BHEL	PARTICULARS	BIDDER / VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER/VENDOR SEAL

NAME
SIGN.
DATE

Prepared By
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23-07-2012

Reviewed By
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23-07-2012

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

	TECHNICAL SPECIFICATIONS	SPECIFICATION NO.:		PE-TS-392-100-N002	
		VOLUME:		IIB	SECTION: D2
		REV. NO.		0	DATE: 20.11.13
		MISCELLANEOUS PUMPS			

SECTION D2

STANDARD MOTOR SPECIFICATION

STANDARD QUALITY PLAN FOR MOTORS



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 : 1 OF 1

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

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

	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 : 1 OF 4

1.0

INTENT OF SPECIFIATION

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 machnines
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
<p>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.</p>		
<p>3.3.3 The following frequency of starts shall apply</p> <p>i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.</p> <p>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)</p> <p>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</p>		
<p>3.4 Running Requirements</p>		
<p>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.</p>		
<p>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.</p>		
<p>3.5 Stress During bus Transfer</p>		
<p>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.</p>		
<p>3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.</p>		
<p>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.</p>		
<p>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.</p>		
<p>4.0 CONSTRUCTIONAL FEATURES</p>		
<p>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</p>		
<p>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.</p>		
<p>Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled</p>		
<p>4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.</p>		


	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 : 3 OF 4
4.4.	Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.	
4.5	Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.	
4.6	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.	
4.7	Terminals and Terminal Boxes	
4.7.1	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. 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”.	
4.7.2	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.	
4.7.3	Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & 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 & V respectively.	
4.7.4	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.	
4.7.5	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.	
4.7.6	Degree of protection for terminal boxes shall be IP 55 as per IS 4691.	
4.7.7	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.	
4.7.8.	Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.	
4.7.9	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.	
4.8	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.	
4.9	General	


	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 : 4 OF 4
<p>4.9.1 Motors provided for similar drives shall be interchangeable.</p> <p>4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.</p> <p>4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.</p> <p>4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.</p> <p>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.</p> <p>4.9.6 Name plate with all particulars as per IS: 325 shall be provided</p> <p>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.</p> <p>5.0 INSPECTION AND TESTING</p> <p>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.</p> <p>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.</p> <p>5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.</p> <p>5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.</p> <p>6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT</p> <p>a) OGA drawing showing the position of terminal boxes, earthing connections etc.</p> <p>b) Arrangement drawing of terminal boxes.</p> <p>c) Characteristic curves: (To be given for motor above 55 kW unless otherwise specified in Data Sheet).</p> <p>i) Current vs. time at rated voltage and minimum starting voltage.</p> <p>ii) Speed vs. time at rated voltage and minimum starting voltage.</p> <p>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.</p> <p>iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.</p>		


		QUALITY PLAN SHEET 1 OF 9		CUSTOMER: RRVUNL		PROJECT: 2 X 660 MW SURATGARH TPS		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR :		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE :				
				SYSTEM :		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION : VOLUME III				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	
1.0	RAW MATERIAL & BOUGHT OUT CONTROL											
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT	3	-	2	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	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	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVANT IS/	SUPPLIER'S TC	3	-	2	
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUFR'S DRG.	MANUFR'S DRG.	LOG BOOK	3	-	2	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	2	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			


		QUALITY PLAN		CUSTOMER : RRVUNL		PROJECT : 2 X 660 MW SURATGARH TPS			SPECIFICATION : NUMBER :			
				BIDDER/ : VENDOR :		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE :			
				SHEET 2 OF 9		SYSTEM :			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION : VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	13
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2	
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	2	
		4.INTERNAL FLAWS	CR	UT	-DO-	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1	
1.6	SPACE HEATERS, CONNECTORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. SPEC.	-DO-	3	-	2	
		2. PHYSICAL COND.	MA	-DO-	-DO-	-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	-DO-	3	-	2	
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	2	
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	2	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
									BIDDER'S/VENDORS COMPANY SEAL			


		QUALITY PLAN SHEET 3 OF 9		CUSTOMER : RRVUNL		PROJECT : 2 X 660 MW SURATGARH TPS			SPECIFICATION : NUMBER :			
				BIDDER/ : VENDOR :		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE :			
				SYSTEM :		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION : VOLUME III			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC. 2. OTHER CHARACTERISTICS	MA MA	VISUAL TEST	100% SAMPLE	- MANUF'S SPEC.	NO VISUAL DEFECTS MANUF'S SPEC.	INSPT. REPORT LOG BOOK AND OR SUPPLIER'S TC	3 3	- -	2 2	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND. 2.DIMENSIONS INCLUDING BURS HEIGHT 3. ACCEPTANCE TESTS	MA MA MA	VISUAL MEASUREMENT ELECT. & MECH TESTS	100% SAMPLE -DO-	- MANUFR'S DRG. . MANUF'S SPEC./ RELEVANT IS	NO VISUAL DEFECTS (FREE FROM BURS) MANUFR'S DRG. RELEVANT IS	LOG BOOK -DO- SUPPLIER'S TC	3 3 3	- - -	- 2 2	FOR MV MOTOR INSULATION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT
1.9	CONDUCTORS	1. SURFACE FINISH 2.ELECT. PROP. & MECH. PROP	MA MA	VISUAL ELECT. & MECH.TEST	100% SAMPLES	- RELEVANT IS/ BS OR OTHER STANDARDS	FREE FROM VISUAL DEFECTS RELEVANT IS/ BS OR OTHER STANDARDS	LOG BOOK SUPPLIERS TC & VENDOR'S INSPN. REPORTS	3* 3	- -	2* 2	* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER.
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			


		QUALITY PLAN		CUSTOMER : RRVUNL		PROJECT : 2 X 660 MW SURATGARH TPS			SPECIFICATION : NUMBER :			
				BIDDER/ :		QUALITY PLAN			SPECIFICATION : TITLE			
				VENDOR		NUMBER PED-506-00-Q-007, REV-03			TITLE			
SHEET 4 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.10	BEARINGS	3.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	-DO-	Log Book	3	-	2	
		1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG./ APPROVED DATASHEET	MANFR'S DRG./ APPROVED DATASHEET	-DO-	3	-	2	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	3	-	2	
		3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	2	
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-DO-	-DO-	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	-DO-	MANUF'S SPEC./ BHEL SPEC.	MANUF'S SPEC./ BHEL SPEC.	-DO-	3	-	2	
		4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	2	
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	MANUF'S DRG/SPECS	MANUF'S DRG./ SPECS.	-DO-	3	-	-	
		2.SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
									BIDDER'S/VENDORS COMPANY SEAL			


		QUALITY PLAN		CUSTOMER : RRVUNL		PROJECT : 2 X 660 MW SURATGARH TPS			SPECIFICATION : NUMBER :			
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
		SHEET 5 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
2.0	IN PROCESS											
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNES	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3/2	2	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	2	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVANT SPEC./ ASTM-E165	MANUF'S SPEC./ BHEL SPEC./	-DO-	2	-	1	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANUF'S SPEC./BHEL SPEC./ RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	2	-	-	
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	2	-	-	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			


		QUALITY PLAN		CUSTOMER : RRVUNL		PROJECT : 2 X 660 MW SURATGARH TPS			SPECIFICATION :			
				BIDDER/ :		TITLE			NUMBER :			
				VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
SHEET 6 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUFR'S SPEC.	MANUFR'S SPEC.	Log Book	2	-	-	(FOR MOTORS OF 2MW AND ABOVE) * ON 10% RANDOM SAMPLE
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	2	-	-	
		3.CORE LOSS & HOTSPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	2	1*	1	
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	2	-	-	FOR MV MOTOR
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		6.SURGE WITH STAND AND TAN. DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
2.6	IMPREGNATION	1.VISCOSCITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-	-	THREE DIPS TO BE GIVEN
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	2	-	-	
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
									BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER : RRVUNL		PROJECT : 2 X 660 MW SURATGARH TPS			SPECIFICATION : NUMBER :			
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
				SHEET 7 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION : VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	VERIFICATION FOR MV MOTOR ONLY
2.8	BRAZING/COMPRESSION JOINT	1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-DO-	-DO-	Log Book	2	-	-	
2.9	COMPLETE ROTOR ASSEMBLY	1.COMPLETENESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.SOUNDNESS	CR	MALLET TEST & UT	-DO-	-DO-	-DO-	Log Book	2		1	
		3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2		1	
2.10	ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	2		1	
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	2		1	
1.ALIGNMENT		MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	-		
2.WORKMANSHIP		MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-		
3.AXIAL PLAY		MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	1		
4.DIMENSIONS		MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IS	Log Book	2	-	-		
5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE		MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2	-	-		
		6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2		1	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE									
BIDDER'S/VENDORS COMPANY SEAL												

		QUALITY PLAN		CUSTOMER : RRVUNL		PROJECT : 2 X 660 MW SURATGARH TPS			SPECIFICATION : NUMBER :			
				BIDDER/ :		QUALITY PLAN			SPECIFICATION :			
				VENDOR :		NUMBER PED-506-00-Q-007, REV-03			TITLE :			
SHEET 8 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC.	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1*	1	* NOTE - 1
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^{\$}	1	^{\$} NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	2	1 ^{\$}	1	^{\$} NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^{\$}	1	^{\$} NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^{\$}	1	^{\$} NOTE - 2
		8. NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1 ^{\$}	1	^{\$} NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1 ^{\$}	1	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY ^{\$} NOTE - 2
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE					BIDDER'S/VENDORS COMPANY SEAL				

		QUALITY PLAN		CUSTOMER RRVUNL		PROJECT 2 X 660 MW SURATGARH TPS		SPECIFICATION :				
				BIDDER/ VENDOR :		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		NUMBER :				
		SHEET 9 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SPECIFICATION : TITLE			SECTION VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
<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, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.</p> <p><u>Legends for Inspection agency</u></p> <p>1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)</p> <p>P. PERFORM W. WITNESS V. VERIFY</p>												
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
									BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER : RRVUNL		PROJECT : 2 X 660 MW SURATGARH TPS		SPECIFICATION :				
				BIDDER/ :		TITLE		NUMBER :				
				VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01		SPECIFICATION TITLE				
SHEET 1 OF 2		SYSTEM		ITEM : AC ELECT. MOTORS BELOW 55KW (LV)		SECTION		VOLUME III				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1		
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	NOTE -1 & NOTE-3
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									

		QUALITY PLAN		CUSTOMER : RRVUNL		PROJECT : 2 X 660 MW SURATGARH TPS		SPECIFICATION :				
				BIDDER/ :		TITLE :		NUMBER :				
		SHEET 2 OF 2		VENDOR :		SYSTEM :		QUALITY PLAN :		SPECIFICATION :		
						NUMBER PED-506-00-Q-006, REV-01		TITLE :				
						ITEM : AC ELECT. MOTORS BELOW 55KW (LV)		SECTION :		VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	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> <p><u>Legends for Inspection agency</u></p> <p>1. BHEL/CUSTOMER</p> <p>2. VENDOR (MOTOR MANUFACTURER)</p> <p>3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)</p> <p>P. PERFORM</p> <p>W. WITNESS</p> <p>V. VERIFY</p>												
BHEL			PARTICULARS		BIDDER/VENDOR					BIDDER'S/VENDORS COMPANY SEAL		
			NAME									
			SIGNATURE									
			DATE									