

NTPC LIMITED

3X660 MW NORTH KARANPURA STPP, UNIT-1,2&3

**TECHNICAL SPECIFICATION
FOR
MISCELLANEOUS PUMPS**

Specification No. : PE-TS-405-100-N001 (REV. 01)



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



TITLE:
**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**
SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-405-100-N001**
SECTION:
SUB-SECTION:
REV. NO. **01** DATE **07/07/2016**
SHEET **1** OF **1**

INDEX

THIS TECHNICAL SPECIFICATION CONSISTS OF FOLLOWING SECTIONS:

CONTENTS

SECTION	TITLE
I	Specific Technical Requirements
IA	Specific Technical Requirements (Mechanical)
IB	Specific Technical Requirements (Elec.)
IC	Specific Technical Requirements (C&I)
ID	Data Sheet – A
II	Standard Technical Specifications
IIA	Standard Technical Specifications (Mechanical)
IIIB	Standard Technical Specifications (Elec.)
III	Documents to be submitted by Bidder
IIIA	Guarantee Schedule (To be submitted along with the Bid by all Bidders)
IIIB	Compliance Certificate (To be submitted along with the Bid by all Bidders)
IIIC	Deviation schedule (To be submitted along with the Bid by all Bidders)
IIID	Data Sheet – B and Other documents (To be submitted by successful Bidder after award of Contract)

Notes:

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

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



TITLE:
**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-405-100-N001**
SECTION:
SUB-SECTION:
REV. NO. **01** DATE **07/07/2016**
SHEET **1** OF **1**

SECTION - I

SPECIFIC TECHNICAL REQUIREMENTS

- SUB-SECTION IA** - Specific Technical Requirements (Mech.)
- SUB-SECTION IB** - Specific Technical Requirements (Electrical)
- SUB-SECTION IC** - Specific Technical Requirements (C & I)
- SUB-SECTION ID** – Datasheet-A



TITLE:
**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: PE-TS-405-100-N001		
SECTION: I		
SUB-SECTION: IA		
REV. NO. 01	DATE	07/07/2016
SHEET 1	OF	1

SUB-SECTION – IA

SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)



TECHNICAL SPECIFICATIONS
MISCELLANEOUS PUMPS
SPECIFIC TECHNICAL REQUIREMENTS

Specification No. : PE-TS-405-100-N001, Rev.01			
SECTION:		IA	
REV. NO.	0	DATE:	07/07/2016

1.0 SCOPE

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

A. 3X660 MW NORTH KARANPURA STPP, UNIT-1,2&3

1.2 The miscellaneous pumps covered under this specification shall be grouped under various group/ type as under:

A. Horizontal (Group-I)

- i) Horizontal Pumps - Type-I (Design Flow < 300 Cu.M/Hr.)
- ii) Horizontal Pumps - Type-II (Design Flow > 300 Cu.M/Hr.)

B. Vertical Pumps (Group-II)

- i) Vertical Pumps - Type-I (Design Flow < 1000 Cu.M/Hr.)

NOTE:-

1. The bidder shall include complete supplies for Pump Type as above in his scope. Part supplies offered for the Pump Type shall disqualify the bidder's offer for that Pump Type.

2. Pump details shall be as per Data Sheet-A at Section-ID.

3. If stated specifically in NIT, bidder shall include complete supplies for 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 miscellaneous pumps and drives covered under this specification for various projects are as per Annexure-1 of this section. HT drives, wherever applicable and irrespective of motor ratings, shall be issued free of cost by BHEL. The details of pumps with HT drives shall be as per Annexure-2 of this section.

The Capacity, Head, Materials of construction, Mandatory spares and other particulars of these pumps, are detailed in Data Sheet-A at Section-ID of the specification.

1.4 For detailed scope of supply & services refer Standard technical Specification for Horizontal Centrifugal pumps & Vertical Pumps specified under Section-II of this specification.

1.5 Electrical scope between BHEL and Vendor for Miscellaneous pumps and drives of this specification shall be as per Annexure-1 of Section-IB of this specification.

1.6 DELIVERY:

Delivery of miscellaneous pumps shall be as per NIT requirement.

2.0 Horizontal Pumps:

2.1 Specific requirements for horizontal pumps shall be as per end customer's specification attached as Annexure-3 of this section.

2.2 For all HT Motor driven pumps, Pump bearing temperature measurement instruments (RTD) along with provision for mounting/ Installation of RTDs on the pump shall be in vendor scope. The Technical Specification for RTDs is attached at Section-IC.

2.3 Conductance of PG Test for noise and vibration at site for Horizontal Pumps is applicable in Bidder Scope as per CI no-3.04.04 of Section -IIA.



TECHNICAL SPECIFICATIONS
MISCELLANEOUS PUMPS
SPECIFIC TECHNICAL REQUIREMENTS

Specification No. : PE-TS-405-100-N001, Rev.01		
SECTION:		IA
REV. NO.	0	DATE: 07/07/2016

3.0 Vertical Pumps:

- 3.1 All Vertical pump motors shall be designed/capable of withstanding max. run away speed during reverse flow. There are no thrust block for countering pump thrust and pump base plate shall be adequately designed to take the unbalanced forces and moments.
- 3.2 Conductance of PG Test for noise and vibration at site for Vertical Pumps is not applicable in Bidder Scope.

4.0 Additional Dispatch Requirements:

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

- 4.1 List of items packed in each box with description & quantity.
- 4.2 Photograph of each box in open & closed condition.
- 4.3 Bidder to include handling instructions in engineering drg/doc and packing to be done in such a way to avoid damage of items in transit and long storage at site and same shall be approved in oncontract stage by BHEL/Customer

5.0 Drawing/Document Submission Schedule:

PACKAGE	BHEL DRG NO	DRG TITLE	Drg Sch for Vendors
MISC.PUM PS (VERTICAL) Type-I	PE-V6A-405-100-N001	TDS AND PERFORMACE CURVES-MISC. PUMPS	R-0 within 20 days from PO & subsequent revisions within 10 days of comments received from BHEL.
	PE-V6A-405-100-N002	GENERAL ARRANGEMENT AND CROSS SECTIONAL-PUMPS	
	PE-V6A-405-100-N003	TDS AND CURVES OF MOTORS FOR MISC. PUMPS	
	PE-V6A-405-100-N004	QP-MISC PUMPS	
	PE-V6A-405-100-N005	QP- MOTORS	R-0 within 20 days of Cat-I (or) II approval on motor document.
	PE-V6A-405-100-N006	MOTOR TYPE TEST DOC (if applicable)	
	PE-V6A-405-100-N007	O& M MANUAL -VER. PUMPS	Within 30 days from MDCC

MISC.PUM PS (HORIZONTAL)-Type-I	PE-V7A-405-100-N001	TDS AND PERFORMACE CURVES-MISC. PUMPS	R-0 within 20 days from PO & subsequent revisions within 10 days of comments received from BHEL.
	PE-V7A-405-100-N002	GENERAL ARRANGEMENT AND CROSS SECTIONAL-PUMPS	
	PE-V7A-405-100-N003	TDS AND CURVES OF MOTORS FOR MISC. PUMPS	
	PE-V7A-405-100-N004	QP-MISC PUMPS	
	PE-V7A-405-100-N005	QP- MOTORS	R-0 within 20 days of Cat-I (or) II approval on motor document.
	PE-V7A-405-100-N006	MOTOR TYPE TEST DOC (if applicable)	
	PE-V7A-405-100-N007	O& M MANUAL -HORZ. PUMPS	Within 30 days from MDCC
	PE-V7A-405-100-N008	PG TEST PROCEDURE -HORZ. PUMPS	Within 30 days from PO.



TECHNICAL SPECIFICATIONS
MISCELLANEOUS PUMPS
SPECIFIC TECHNICAL REQUIREMENTS

Specification No. : PE-TS-405-100-N001, Rev.01
SECTION: IA
REV. NO. 0 DATE: 07/07/2016

MISC.PUMPS (HORIZONTAL)-Type-II	PE-V7B-405-100-N001	TDS AND PERFORMANCE CURVES-MISC. PUMPS	R-0 within 20 days from PO & subsequent revisions within 10 days of comments received from BHEL.
	PE-V7B-405-100-N002	GENERAL ARRANGEMENT AND CROSS SECTIONAL-PUMPS	
	PE-V7B-405-100-N003	TDS AND CURVES OF MOTORS FOR MISC. PUMPS	
	PE-V7B-405-100-N004	QP-MISC PUMPS	
	PE-V7B-405-100-N005	QP- MOTORS	R-0 within 20 days of Cat-I (or) II approval on motor document.
	PE-V7B-405-100-N006	MOTOR TYPE TEST DOC (if applicable)	
	PE-V7B-405-100-N007	O& M MANUAL -HORZ. PUMPS	Within 30 days from MDCC
	PE-V7B-405-100-N008	PG TEST PROCEDURE -HORZ. PUMPS	Within 30 days from PO.



TECHNICAL SPECIFICATIONS
MISCELLANEOUS PUMPS
SPECIFIC TECHNICAL REQUIREMENTS

Specification No. : PE-TS-405-100-N001, Rev.01

SECTION: IA

REV. NO. 0 DATE: 07/07/2016

Annexure-1

List of Miscellaneous Pumps and drives for :

A. 3X660 MW NORTH KARANPURA STPP, UNIT-1,2&3

Sl. No.	Pump Description	Total Qty.	Type of Pumps
	Horizontal Pumps (Type-I)		
1	SERVICE WATER PUMPS	4 nos.	Horizontal-Type-I
2	HVAC M/U PUMP	2 nos.	Horizontal-Type-I
3	ACW M/U PUMP	3 nos.	Horizontal-Type-I
4	DM WATER M/UP PUMP	4 nos.	Horizontal-Type-I
5	BOILER FILL PUMPS	2 nos.	Horizontal-Type-I

Sl. No.	Pump Description	Total Qty.	Type of Pumps
	Horizontal Pumps (Type-II)		
1	DMCW TG AUX. PUMPS	9 nos.	Horizontal-Type-II
2	DMCW SG AUX. PUMPS	6 nos.	Horizontal-Type-II
3	ACW PUMPS	9 nos.	Horizontal-Type-II
4	AHS COOLING PUMPS	2 nos.	Horizontal-Type-II
5	APH/ESP WASH PUMP	2 nos.	Horizontal-Type-II
6	CONDENSATE TRANSFER PUMP	3 nos.	Horizontal-Type-II

Sl. No.	Pump Description	Total Qty.	Type of Pumps
	Vertical Pumps (Type-I)		
1	PLANT POTABLE WATER PUMPS	2 nos.	Vertical Type-I
2	COLONY POTABLE WATER PUMP	2 nos.	Vertical Type-I



TECHNICAL SPECIFICATIONS
MISCELLANEOUS PUMPS
SPECIFIC TECHNICAL REQUIREMENTS

Specification No. : PE-TS-405-100-N001, Rev.01

SECTION: IA

REV. NO. 0 DATE: 07/07/2016

Annexure-2

Following HT drives for 3X660 MW NORTH KARANPURA STPP, UNIT-1,2&3, irrespective of Motor ratings shall be issue free, by BHEL:

Horizontal Pumps (Type-I):


NIL


Horizontal Pumps (Type-II):


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


Vertical Pumps (Type-I):


NIL

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	<p style="text-align: right;">Annexure –3</p> <p style="text-align: center;">GENERAL SPECIFICATION FOR HORIZONTAL PUMPS</p> <p>1) SCOPE</p> <p>This specification covers the design, material, construction features, manufacture, inspection, testing the performance at the Vendor's/Sub-Vendor's Works and delivery to site of Horizontal Centrifugal Pumps.</p> <p>2) CODES AND STANDARDS</p> <p>The design, material, construction, manufacture inspection and performance testing of Horizontal Centrifugal Pumps shall comply with all currently applicable statutes, regulations and safety codes in the locality where the Equipment will be installed. Nothing in these specifications shall be construed to relieve the Vendor of this responsibility. The Equipment supplied shall comply with the latest applicable Indian Standards listed below. Other National Standards are acceptable, if they are established to be equal or superior to the Indian Standards.</p> <p>3) List of Applicable Standards.</p> <p>IS : 1520 : Horizontal Centrifugal Pumps for clear cold fresh water</p> <p>IS : 5120 : Technical requirements of rotodynamic special purpose pumps</p> <p>API : 610 : Centrifugal pumps for general refinery service.</p> <p>IS : 5639 : Pumps Handling Chemicals & corrosion liquids</p> <p>IS : 5659 : Pumps for process water</p> <p>HIS : Hydraulic Institute Standards, USA</p> <p>ASTM-1-165-65 Standards Methods for Liquid Penetration Inspection.</p> <p>In case of any contradiction with aforesaid standards and the stipulations as per the technical specifications as specified hereinafter the stipulations of the technical specifications shall prevail.</p> <p>4) DESIGN REQUIREMENTS</p> <p>a) The Pump shall be capable of developing the required total head at rated capacity for continuous operation. Also the pumps shall be capable of being operated to give satisfactory performance at any point on the HQ characteristics curve. The operating range of the pump shall be 40% to 120% of the duty point unless otherwise mentioned elsewhere. The maximum efficiency of pump shall preferably be within $\pm 10\%$ of the rated design flow as indicated in data sheets.</p>			
<p style="text-align: center;">NORTH KARANPURA STPP (3X660MW) EPC PACKAGE</p>	<p style="text-align: center;">TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO. CS-4410-001-2</p>	<p style="text-align: center;">Sub Section-A-15 Air Conditioning System</p>	<p style="text-align: center;">Page 27 of 32</p>	

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	Annexure -3			
b)	The total head capacity curve shall be continuously rising from the operating point towards shut-off without any zone of instability and with a minimum shut-off head of about 15% more than the design head.			
c)	Pumps of a particular category shall be identical and shall be suitable for parallel operation with equal load division. The head Vs capacity and BHP Vs capacity characteristics should match to ensure even load sharing and trouble free operation throughout the range. Components of identical pumps shall be interchangeable.			
d)	Pumps shall run smoothly without undue noise and vibration. Peak to peak vibration limits shall be restricted to the following values during operation:			
	Speed	Antifriction Bearing	Sleeve Bearing	
	1500 rpm and below	75.0 micron	75.0 micron	
	3000 rpm	50.0 micron	65.0 micron	
	The noise level shall not exceed 85 dBA overall sound pressure level reference 0.0002 microbar (the standard pressure reference for air sound measurement) at a distance of 1 M from the equipment surface.			
e)	The pumps shall be capable of starting with discharge valve fully open and close condition. Motors shall be selected to suit to the above requirements. Continuous Motor rating (at 50 deg.C ambient) shall be atleast ten percent (10%) above the maximum load demand of the pump in the entire operating range to take care of the system frequency variation and no case less than the maximum power requirement at any condition of the entire characteristic curve of the pump.			
f)	The kW rating of the drive unit shall be based on continuously driving the connected equipment for the conditions specified. However, in cases where parallel operation of the pumps are specified, the actual motor rating is to be selected by the Bidder considering overloading of the pumps in the event of tripping of operating pump(s).			
g)	Pumps shall be so designed that pump impellers and other accessories of the pumps are not damaged due to flow reversal.			
h)	The Contractor under this specification shall assume full responsibility in the operation of pump and motor as a unit.			
5)	DESIGN CONSTRUCTION			
a)	Design and construction of various components of the pumps shall conform to the following general specifications. For material of construction of the components, data sheets shall be referred to.			
NORTH KARANPURA STPP (3X660MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO. CS-4410-001-2	Sub Section-A-15 Air Conditioning System	Page 28 of 32	

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	<p style="text-align: right;">Annexure -3</p> <p>b) Pump Casing</p> <p>Pump casing shall have axially or radially split type construction as specified. The casing shall be designed to withstand the maximum shut-off pressure developed by the pump at the pumping temperature.</p> <p>Pump casing shall be provided with a vent connection and piping with fittings & valves. Casing drain as required shall be provided complete with drain valves, piping and plugs. It shall be provided with a connection for suction and discharge pressure gauge as standard feature. It shall be structurally sound to provide housing for the pump assembly and shall be designed hydraulically to minimum radial load at part load operation.</p> <p>c) Impeller</p> <p>Impeller shall be closed, semi-closed or open type as specified elsewhere and designed in conformance with the detailed analysis of the liquid being handled.</p> <p>The impeller shall be secured to the shaft, and shall be retained against circumferential movement by keying, pinning or lock rings. On pumps with overhung shaft, impellers shall be secured to the shaft by a lockout or cap screw which tightness in the direction of normal rotation.</p> <p>d) Impeller/Casing Wearing Rings</p> <p>Replaceable type wearing rings shall be provided at suitable locations of pumps. Suitable method of locking the wearing ring shall be used. Wearing rings shall be provided in pump casing and/or impeller as per manufacturer's standard practice.</p> <p>e) Shaft</p> <p>The critical speed shall be well away from the operating speed and in no case less than 130% of the rated speed.</p> <p>The shaft shall be ground and polished to final dimensions and shall be adequately sized to withstand all stresses from rotor weight, hydraulic loads, vibration and torques coming in during operation.</p> <p>f) Shaft Sleeves</p> <p>Renewable type fine finished shaft sleeves shall be provided at the stuffing boxes/mechanical seals. Length of the shaft sleeves must extend beyond the outer faces of gland packing of seal end plates so as to distinguish between the leakage between shaft and shaft sleeve and that past the seals/gland.</p> <p>Shaft sleeves shall be fastened to the shaft to prevent any leakage or loosening. Shaft and shaft sleeve assembly should ensure concentric rotation.</p>			
<p>NORTH KARANPURA STPP (3X660MW) EPC PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO. CS-4410-001-2</p>	<p>Sub Section-A-15 Air Conditioning System</p>	<p>Page 29 of 32</p>	

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	Annexure –3			
g)	<p>Bearings</p> <p>Heavy duty bearings, adequately designed for the type of service specified in the enclosed pump data sheet and for long, trouble free operation shall be furnished.</p> <p>The bearings offered shall be capable of taking both the radial and axial thrust coming into play during operation. In case, sleeve bearings are offered additional thrust bearings shall be provided. Antifriction bearings of standard type, if provided, shall be selected for a minimum life 20,000 hrs. of continuous operation at maximum axial and radial loads and rated speed.</p> <p>Proper lubricating arrangement for the bearings shall be provided. The design shall be such that the bearing lubricating element does not contaminate the liquid pumped. Where there is a possibility of liquid entering the bearings suitable arrangement in the form of deflectors or any other suitable arrangement must be provided ahead of bearings assembly.</p> <p>Bearings shall be easily accessible without disturbing the pump assembly. A drain plug shall be provided at the bottom of each bearings housing.</p>			
h)	<p>Stuffing Boxes</p> <p>Stuffing box design should permit replacement of packing without removing any part other than the gland.</p> <p>Stuffing boxes of packed ring construction type shall be provided wherever specified. Packed ring stuffing boxes shall be properly lubricated and sealed as per service requirements and manufacturer's standards. If external gland sealing is required, it shall be done from the pump discharge. The Bidder shall provide the necessary piping valves, fittings etc. for the gland sealing connection.</p>			
i)	<p>Mechanical Seals</p> <p>Wherever specified in pump data sheet, mechanical seals shall be provided. Unless otherwise recommended by the tenderer, mechanical seals shall be of single type with either sliding gasket or bellows between the axially moving face and shaft sleeves or any other suitable type. The sealing faces should be highly lapped surfaces of materials known for their low frictional coefficient and resistance to corrosion against the liquid being pumped.</p>			
j)	<p>The pump supplier shall coordinate with the seal maker in establishing the seal chamber of circulation rate for maintaining a stable film at the seal face. The seal piping system shall form an integral part of the pump assembly. For the seals under vacuum service, the seal design must ensure sealing against atmospheric pressure even when the pumps are not operating. Necessary provision for seal water supply along with complete piping fittings and valves as required shall form integral part of pump supply.</p>			
NORTH KARANPURA STPP (3X660MW) EPC PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO. CS-4410-001-2	Sub Section-A-15 Air Conditioning System	Page 30 of 32	

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	<p style="text-align: right;">Annexure -3</p> <p>k) Pump Shaft Motor Shaft Coupling</p> <p>The pump and motor shafts shall be connected with an adequately sized flexible coupling of proven design with a spacer to facilitate dismantling of the pump without disturbing the motor. Necessary coupling guards shall also be provided.</p> <p>l) Base Plate</p> <p>A common base plate mounting both for the pump and motor shall be furnished. The base plate shall be fabricated steel and of rigid construction, suitably ribbed and reinforced. Base plate and pump supports shall be so constructed and the piping unit so mounted as to minimise misalignment caused by mechanical forces such as normal piping strain, internal differential thermal expansion and hydraulic piping thrust. Suitable drain troughs and drip lip shall be provided.</p> <p>m) Assembly and Dismantling</p> <p>Assembly and dismantling of each pump with drive motor shall be possible without disturbing the grouting base plate or alignment.</p> <p>n) Drive Motor (Prime Mover)</p> <p>The kW rating of the drive shall be based on continuously driving the connected equipment for the conditions specified. However, in cases where parallel operation of the pumps are specified, the actual motor rating is to be selected by the Bidder considering overloading of the pumps in the event of tripping of operating pump(s).</p>			
<p>NORTH KARANPURA STPP (3X660MW) EPC PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO. CS-4410-001-2</p>	<p>Sub Section-A-15 Air Conditioning System</p>	<p>Page 31 of 32</p>	



TITLE:
**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-405-100-N001**
SECTION: **I**
SUB-SECTION: **IB**
REV. NO. **01** DATE **07/07/2016**
SHEET **1** OF **1**

SUB-SECTION – IB

SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)



TITLE :
**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
MISC PUMPS
3X660MW NORTH KARANPURA STPP**

SPECIFICATION NO.
PE-TS-405-100-N001

SECTION : I

SUB-SECTION : I-B

REV NO. : 01 DATE : 07.07.16

SHEET : 1 OF 3

**TECHNICAL SPECIFICATION FOR
MISCELLANEOUS PUMP
(ELECTRICAL PORTION)**



TITLE :
**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
MISC PUMPS
3X660MW NORTH KARANPURA STPP**

SPECIFICATION NO.
PE-TS-405-100-N001

SECTION : I

SUB-SECTION : I-B

REV NO. : 01 DATE : 07.07.16

SHEET : 2 OF 3

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) Bidder shall furnish all AC as well as DC loads required for the system at different voltage levels (eg. 415V AC, 240 V AC, 220 V DC etc.) of all types, such as motor feeders, supply feeders in PEM format along with the offer.
- e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL
- g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
- h) Motor shall meet minimum requirement of motor specification.
- i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- j) Cable BOQ worked out based on routing of cable listing provided by the vendor for “ both end equipment in vendor’s scope”shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

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

Refer “Electrical Scope between BHEL and Vendor”.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate.

3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.



TITLE :
**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
MISC PUMPS
3X660MW NORTH KARANPURA STPP**

SPECIFICATION NO.
PE-TS-405-100-N001

SECTION : I

SUB-SECTION : I-B

REV NO. : 01 DATE : 07.07.16

SHEET : 3 OF 3

4.0 List of enclosures :

- a) Electrical scope between BHEL & vendor (Annexure –I)
- b) NTPC Technical specification and standard BHEL specification for motors.
- c) Datasheets(A&C) & quality plan for motors(BHEL & NTPC).
- d) Electrical Load data format (SECTION-IIID)
- e) BHEL cable listing format (SECTION-IIID)

ANNEXURE – I TO SECTION – C: STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR
PACKAGE: MISC. PUMP (Supply Package)

PROJECT: KARANPURA

<u>S.NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1	415 V MCC	BHEL	BHEL	1. BHEL will provide two suitable Power supply feeders to incoming terminal point of vendor equipment.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motors.
3	Power cables, control cables and screened control cables	BHEL	BHEL	1. Incoming cable from BHEL supplied MCC will be informed by BHEL. Screened control cable between DCS & field equipment will also be informed by BHEL. Vendor shall provide lugs & glands accordingly.
4	Any special type of cable like compensating, co-axial, prefab, MICC, fibre optical etc	Vendor	BHEL	
5	Cable trays, accessories & cable trays supporting system	BHEL	BHEL	
6	Cable glands and lugs for equipments supplied by Vendor	Vendor	BHEL	1. Tinned brass, double compression cable glands. 2. Solder less crimping type heavy duty tinned copper lugs for power cables 3. Solder less crimping type heavy duty copper lugs for control cables.
7	Conduit and conduit accessories for cabling between equipments supplied by vendor	Vendor	BHEL	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537. Makes of conduits shall be subject to NTPC/ BHEL approval at contract stage.
8	Equipment grounding & lightning protection	BHEL	BHEL	
9	Junction box/Terminal Box for control & instrumentation cable	Vendor	-	
10	Below grade grounding	BHEL	BHEL	
11	LT Motors with base plate and foundation hardware	Vendor	BHEL	Makes shall be subject to BHEL approval at contract stage.
12	Mandatory spares	Vendor	-	Vendor to quote as per specification.
13	Recommended O & M spares, E & C spares, erection & maintenance tools & tackle	Vendor	-	As per specification
14	Any other equipment/material/service required for completeness of system but not specified above (to ensure trouble free and efficient operation of the system).	Vendor	BHEL	
15	a) Input cable schedules b) Cable interconnection detail for the above c) Cable block diagram	vendor vendor vendor	- - -	Cable listing for control cables for vendor supplied equipment (soft copies in the CUSTOMER cable schedule format) shall be furnished during detail engineering by vendor.

ANNEXURE – I TO SECTION – C: STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR
PACKAGE: MISC. PUMP (Supply Package)


16	Equipment layout drawings	Vendor	-	For ensuring cabling requirements are met, vendor shall furnish layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipments requiring cabling, and shall incorporate cable routing details marked on the drawing as per CUSTOMER interface comments. Electrical equipment layout drawing shall be to CUSTOMER approval.
17	Electrical equipment GA drawing	Vendor	-	For necessary interface review.


NOTES:


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


SPECIFIC ELECTRICAL REQUIREMENT FOR MISC PUMPS**DATA SHEET-A**


SL.NO.	PARAMETERS	UNIT	NORHT KARANPURA
MOTOR			
1	DESIGN AMBIENT TEMP	DEG. C	50
2	VOLTAGE SUPPLY AND VARIATION	VOLT	415V, \pm 10%
3	FREQUENCY WITH VARIATION	Hz	50(+ 3% to - 5%)
4	COMBINED VOLTAGE & FREQUENCY VARIATION		10% (absolute)
5	MAX ACCEPTABLE RATING OF MOTOR AT 415 V	KW	(Upto) 160 KW, 3.3kv for 160kW and above
6	SYSTEM FAULT LEVEL AND ITS DURATION	KA	50kA for 1sec
7	SUTABILITY OF TERMINAL BOX FOR FAULT LEVEL AND DURATION		50 KA, 0.2 sec
8	CLASS OF INSULATION & TEMP RISE LIMITED TO		THERMAL CLASS B or better
9	MIN. STARTING VOLTAGE		85% below 110kW 80% from 110kW to 200kW
10	MOTOR RATING FOR SINGLE PHASE SUPPLY		0.2 kW & Below
11	RATIO OF LOCKED ROTOR KVA at rared voltage to RATED KW		10 for BELOW 110kW 9 for 110 kW to 200kW
12	ACCEPTABLE NOISE LEVEL	DB	85dB(A)
13	TYPE OF STARTER PROVIDED IN MCC		DOL
14	DOP OF ENCLOSURE		IP-55 & IP-54 for outdoor & indoor resp as per IS 4691 & IEC 60034-05.
15	SPACE HEATER REQUIREMENT	>30kW	30KW & ABOVE
16	PAINT SHADE		RAL - 5012 (blue)
17	SPECIAL REQUIREMENT		TYPE TEST REPORTS MORE THAN 10 YEARS OLD FROM THE DATE OF BID OPENING ARE NOT ACCEPTABLE
18	ENERGY EFFICIENT		PREMIUM EFFICIENCY IE3 up to 160kW conforming to IS 12615 & IEC-60034-30
19	LIST OF MAKE		BHARAT BIJLI,KEC,MARATHON,CGL,ABB (list is tentative, subject to customer approval during detailed engineering)


CLAUSE NO.	TECHNICAL REQUIREMENTS																		
MOTORS																			
1.00.00	GENERAL REQUIREMENTS																		
1.01.00	For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment.																		
1.02.00	All equipments shall be suitable for rated frequency of 50 Hz with a variation of +3% & - 5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.																		
1.03.00	Contractor shall provide fully compatible electrical system, equipments, accessories and services.																		
1.04.00	All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.																		
1.05.00	Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.																		
1.06.00	The responsibility of coordination with electrical agencies and obtaining all necessary clearances for contractors equipment and systems shall be under the contractor scope.																		
1.07.00	<p>Degree of Protection</p> <p>Degree of protection for various enclosures as per IS:4691, IEC60034-05 shall be as follows :-</p> <table border="0" data-bbox="363 1317 1010 1529"> <tr> <td>i) Indoor motors</td> <td>-</td> <td>IP 54</td> </tr> <tr> <td>ii) Outdoor motors</td> <td>-</td> <td>IP 55</td> </tr> <tr> <td>iii) Cable box-indoor area</td> <td>-</td> <td>IP 54</td> </tr> <tr> <td>iv) Cable box-Outdoor area</td> <td>-</td> <td>IP 55</td> </tr> </table>				i) Indoor motors	-	IP 54	ii) Outdoor motors	-	IP 55	iii) Cable box-indoor area	-	IP 54	iv) Cable box-Outdoor area	-	IP 55			
i) Indoor motors	-	IP 54																	
ii) Outdoor motors	-	IP 55																	
iii) Cable box-indoor area	-	IP 54																	
iv) Cable box-Outdoor area	-	IP 55																	
2.00.00	CODES AND STANDARDS																		
<table border="0" data-bbox="363 1630 1233 1944"> <tr> <td>1) Three phase induction motors</td> <td>:</td> <td>IS:325, IEC:60034</td> </tr> <tr> <td>2) Single phase AC motors</td> <td>:</td> <td>IS:996, IEC:60034</td> </tr> <tr> <td>3) Crane duty motors</td> <td>:</td> <td>IS:3177, IEC:60034</td> </tr> <tr> <td>4) DC motors/generators</td> <td>:</td> <td>IS:4722</td> </tr> <tr> <td>5) Energy Efficient motors</td> <td>:</td> <td>IS 12615, IEC:60034-30</td> </tr> </table>					1) Three phase induction motors	:	IS:325, IEC:60034	2) Single phase AC motors	:	IS:996, IEC:60034	3) Crane duty motors	:	IS:3177, IEC:60034	4) DC motors/generators	:	IS:4722	5) Energy Efficient motors	:	IS 12615, IEC:60034-30
1) Three phase induction motors	:	IS:325, IEC:60034																	
2) Single phase AC motors	:	IS:996, IEC:60034																	
3) Crane duty motors	:	IS:3177, IEC:60034																	
4) DC motors/generators	:	IS:4722																	
5) Energy Efficient motors	:	IS 12615, IEC:60034-30																	
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-07 MOTORS	Page 1 of 9																


CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.00.00	TYPE			
3.01.00	AC Motors: <ol style="list-style-type: none"> a) Squirrel cage induction motor suitable for direct-on-line starting. b) Continuous duty LT motors upto 160 KW Output rating (at 50 deg.C ambient temperature), shall be Premium Efficiency class-IE3, conforming to IS 12615, or IEC:60034-30. c) Crane duty motors shall be slip ring/ squirrel cage Induction motor as per the requirement. 			
3.02.00	DC Motors	Shunt wound.		
4.00.00	RATING			
5.00.00	TEMPERATURE RISE Air cooled motors 70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation. Water cooled 80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation.			
6.00.00	OPERATIONAL REQUIREMENTS			
6.01.00	Starting Time			
6.01.01	For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.			
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-07 MOTORS	Page 2 of 9	


CLAUSE NO.	TECHNICAL REQUIREMENTS			
6.01.02	For motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than starting time.			
6.01.03	For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.			
6.01.04	Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.			
6.02.00	Torque Requirements			
6.02.01	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.			
6.02.02	Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.			
6.03.00	Starting voltage requirement (a) 85% below 110 KW (b) 80% from 110 KW to 200 KW (c) 85% above 200 KW to 1000 KW (d) 80% from 1001 KW to 4000 KW (e) 75% above 4000KW Except AOP & JOP motors running on D.G emergency supply, starting voltage shall be 80%.			
7.00.00	DESIGN AND CONSTRUCTIONAL FEATURES			
7.01.00	Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided. However for flame proof motors , space heater terminals inside the main terminal box may be acceptable.			
7.02.00	All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACW) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). Motors and EPB located in hazardous areas shall have flame proof enclosures conforming to IS:2148 as detailed below (a) Fuel oil area : Group – IIB			
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-07 MOTORS	Page 3 of 9	

CLAUSE NO.	TECHNICAL REQUIREMENTS		
7.03.00	(b) Hydrogen generation Winding and Insulation (a) Type (b) Starting duty (c) 11kV & 3.3 kV AC motors (d) 240VAC, 415V AC & 220V DC motors	:Group - IIC or (Group-I, Div-II as per plant area NEC) or (Class-1, Group-B, Div-II as per NEMA /IEC60034) : Non-hygroscopic, oil resistant, flame resistant : Two hot starts in succession, with motor initially at normal running temperature. : Thermal class 155 (F) insulation. The winding insulation process shall be total Vacuum Pressure Impregnated i.e resin poor method. The lightning Impulse & interturn insulation surge withstand level shall be as per IEC-60034 part-15 : Thermal Class(B) or better	
7.04.00	Motors rated above 1000KW shall have insulated bearings to prevent flow of shaft currents.		
7.05.00	Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.		
7.06.00	Noise level for all the motors shall be limited to 85dB(A) except for BFP motor for which the maximum limit shall be 90dB(A). Vibration shall be limited within the limits prescribed in IS:12075 / IEC 60034-14 . Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.		
7.07.00	In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer with adjustable alarm contact and preferably 2 numbers duplex platinum resistance type temperature detectors.		
7.08.00	Motor body shall have two earthing points on opposite sides.		
7.09.00	11 KV motors shall be offered with Separate Insulated Connector (Elastimould or Equivalent make) as per IEEE 386. The offered Elastimould terminations shall be provided with protective cover and trifurcating sleeves. Elastimould termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.		
7.10.00	3.3 KV motors shall be offered with dust tight phase separated double walled (metallic as well as insulated barrier) Terminal box. Suitable termination kit shall be provided for the offered Terminal box. The offered Terminal Box shall be suitable for fault level of 250		
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-07 MOTORS	Page 4 of 9

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	<p>MVA for 0.12 sec. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) shall be provided.</p>			
7.11.00	<p>The spacing between gland plate & centre of terminal stud shall be as per Table-I.</p>			
7.12.00	<p>All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.</p>			
7.13.00	<p>The motors shall be suitable for bus transfer schemes provided on the 11kV, 3.3 kV /415V systems without any injurious effect on its life.</p>			
7.14.00	<p>For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.</p>			
7.15.00	<p>The size and number of cables (for HT and LT motors) to be intimated to the successful bidder during detailed engineering and the contractor shall provide terminal box suitable for the same.</p>			
8.00.00	<p>The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance) except for BFP motor.</p> <p>(a) Below 110KW : 10.0</p> <p>(b) From 110 KW & upto 200 KW : 9.0</p> <p>(c) Above 200 KW & upto 1000KW : 10.0</p> <p>(d) From 1001KW & upto 4000KW : 9.0</p> <p>(e) Above 4000KW : 6 to 6.5</p>			
10.00.00	<p>TYPE TEST</p>			
10.01.00	<p>HT MOTORS</p>			
10.01.01	<p>The contractor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The bidder shall indicate the charges for each of these type tests separately in the relevant schedule of Section - VII- (BPS) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the employer's engineer.</p>			
10.01.02	<p>The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days notice shall be given by the contractor. The contractor shall obtain the employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set-up, instruments to be used, procedure,</p>			
<p>NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE</p>	<p>TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2</p>	<p>SUB SECTION B-07 MOTORS</p>	<p>Page 5 of 9</p>	

CLAUSE NO.	TECHNICAL REQUIREMENTS			
<p>10.01.03</p> <p>10.01.04</p> <p>10.01.05</p>	<p>acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.</p> <p>In case the contractor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering the type test reports to the Employer for waiver of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The Employer reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the contractor.</p> <p>Further the Contractor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED" and carried out within last ten years from the date of bid opening. These reports</p> <p>should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval.</p> <p>LIST OF TYPE TESTS TO BE CONDUCTED</p> <p>The following type tests shall be conducted on each type and rating of HT motor</p> <p>(a) No load saturation and loss curves upto approximately 115% of rated voltage</p> <p>(b) Measurement of noise at no load.</p> <p>(c) Momentary excess torque test (subject to test bed constraint).</p> <p>(d) Full load test(subject to test bed constraint)</p> <p>(e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.</p>			
<p>NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE</p>	<p>TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2</p>	<p>SUB SECTION B-07 MOTORS</p>	<p>Page 6 of 9</p>	

CLAUSE NO.	TECHNICAL REQUIREMENTS			
10.01.06	<p>LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED</p> <p>The following type test reports shall be submitted for each type and rating of HT motor</p> <ul style="list-style-type: none"> (a) Degree of protection test for the enclosure followed by IR, HV and no load run test. (b) Terminal box-fault level withstand test for each type of terminal box of HT motors only. (c) Lightning Impulse withstand test on the sample coil shall be as per clause no. 4.3 IEC-60034, part-15 (d) Surge-withstand test on interturn insulation shall be as per clause no. 4.2 of IEC 60034, part-15 			
10.02.00	<p>LT Motors</p>			
10.02.01	<p>LT Motors supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Employer's approval the reports of all the type tests as listed in this specification and carried out within last <i>ten</i> years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.</p>			
10.02.02	<p>However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval.</p>			
10.02.03	<p>LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED</p> <p>The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only</p> <ul style="list-style-type: none"> 1. Measurement of resistance of windings of stator and wound rotor. 2. No load test at rated voltage to determine input current power and speed 3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors) 4. Full load test to determine efficiency power factor and slip . 5. Temperature rise test . 6. Momentary excess torque test. 7. High voltage test . 			
<p>NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE</p>	<p>TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2</p>	<p>SUB SECTION B-07 MOTORS</p>	<p>Page 7 of 9</p>	

CLAUSE NO.	TECHNICAL REQUIREMENTS																						
<p>10.03.00</p> <p>10.04.00</p>	<p>8. Test for vibration severity of motor.</p> <p>9. Test for noise levels of motor(Shall be limited as per clause no 7.06.00 of this section)</p> <p>10. Test for degree of protection and</p> <p>11. Over speed test.</p> <p>12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1</p> <p>All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.</p> <p>The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and “No design Change”. Minor changes if any shall be highlighted on the endorsement sheet.</p> <p style="text-align: center;">TABLE - I</p> <p style="text-align: center;">DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS</p> <table border="0" style="width: 100%;"> <thead> <tr> <th style="text-align: left;">Motor MCR in KW</th> <th style="text-align: right;">Minimum distance between centre of stud and gland plate in mm</th> </tr> </thead> <tbody> <tr> <td>UP to 3 KW</td> <td style="text-align: right;">As per manufacturer's practice.</td> </tr> <tr> <td>Above 3 KW - upto 7 KW</td> <td style="text-align: right;">85</td> </tr> <tr> <td>Above 7 KW - upto 13 KW</td> <td style="text-align: right;">115</td> </tr> <tr> <td>Above 13 KW - upto 24 KW</td> <td style="text-align: right;">167</td> </tr> <tr> <td>Above 24 KW - upto 37 KW</td> <td style="text-align: right;">196</td> </tr> <tr> <td>Above 37 KW - upto 55 KW</td> <td style="text-align: right;">249</td> </tr> <tr> <td>Above 55 KW - upto 90 KW</td> <td style="text-align: right;">277</td> </tr> <tr> <td>Above 90 KW - upto 125 KW</td> <td style="text-align: right;">331</td> </tr> <tr> <td>Above 125 KW-upto 200 KW</td> <td style="text-align: right;">203</td> </tr> </tbody> </table> <p>For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm.</p>	Motor MCR in KW	Minimum distance between centre of stud and gland plate in mm	UP to 3 KW	As per manufacturer's practice.	Above 3 KW - upto 7 KW	85	Above 7 KW - upto 13 KW	115	Above 13 KW - upto 24 KW	167	Above 24 KW - upto 37 KW	196	Above 37 KW - upto 55 KW	249	Above 55 KW - upto 90 KW	277	Above 90 KW - upto 125 KW	331	Above 125 KW-upto 200 KW	203		
Motor MCR in KW	Minimum distance between centre of stud and gland plate in mm																						
UP to 3 KW	As per manufacturer's practice.																						
Above 3 KW - upto 7 KW	85																						
Above 7 KW - upto 13 KW	115																						
Above 13 KW - upto 24 KW	167																						
Above 24 KW - upto 37 KW	196																						
Above 37 KW - upto 55 KW	249																						
Above 55 KW - upto 90 KW	277																						
Above 90 KW - upto 125 KW	331																						
Above 125 KW-upto 200 KW	203																						
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-07 MOTORS	Page 8 of 9																				

	<p>PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:</p> <p>NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:</p> <table style="width: 100%; margin-top: 10px;"> <thead> <tr> <th style="text-align: left; width: 60%;">Motor MCR in KW</th> <th style="text-align: left;">Clearance</th> </tr> </thead> <tbody> <tr> <td>UP to 110 KW</td> <td>10mm</td> </tr> <tr> <td>Above 110 KW and upto 150 KW</td> <td>12.5mm</td> </tr> <tr> <td>Above 150 KW</td> <td>19mm</td> </tr> </tbody> </table>	Motor MCR in KW	Clearance	UP to 110 KW	10mm	Above 110 KW and upto 150 KW	12.5mm	Above 150 KW	19mm
Motor MCR in KW	Clearance								
UP to 110 KW	10mm								
Above 110 KW and upto 150 KW	12.5mm								
Above 150 KW	19mm								



MOTOR

TESTS/CHECKS TEMS/COMPONENTS	Visual	Dimensional	Make/Type/Rating /General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment
Plates for stator frame, end shield, spider etc.	Y	Y	Y	Y	Y				Y
Shaft	Y	Y	Y	Y	Y	Y			Y
Magnetic Material	Y	Y	Y	Y			Y		
Rotor Copper/Aluminium	Y	Y	Y	Y			Y		Y
Stator copper	Y	Y	Y	Y			Y		Y
SC Ring	Y	Y	Y	Y	Y		Y	Y	Y
Insulating Material	Y		Y	Y			Y		
Tubes, for Cooler	Y	Y	Y	Y	Y				Y
Sleeve Bearing	Y	Y	Y	Y	Y				Y
Stator/Rotor, Exciter Coils	Y	Y	Y				Y	Y	
Castings, stator frame, terminal box and bearing housing etc.	Y	Y	Y	Y	Y			Y	
Fabrication & machining of stator, rotor, terminal box	Y	Y			Y			Y	Y
Wound stator	Y	Y					Y	Y	
Wound Exciter	Y	Y					Y	Y	
Rotor complete	Y	Y					Y		
Exciter, Stator, Rotor, Terminal Box assembly	Y	Y					Y		
Accessories, RTD, BTD,CT, Space heater, antifriction bearing, gaskets etc.	Y	Y	Y						
Complete Motor	Y	Y	Y						

Note: 1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. ~~However, No QP for LT motor upto 50kW.~~ Refer separate QP for motors below 50kw.
 2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard
 3. Makes of major bought out items for HT motors will be subject to NTPC approval.
 Y1 = for HT Motor / Machines only.



MOTOR

ITEMS/COMPONENTS	Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	Routine & Acceptance tests as per IS-325/IS-4722 /IS- 9283/IS 2148/IEC60034/IEC 60079-I	vibration	Over speed	Tan delta, shaft voltage & polarization index test	Paint shade, thickness & adhesion
Plates for stator frame, end shield, spider etc.										
Shaft										
Magnetic Material	Y		Y							
Rotor Copper/Aluminium										
Stator copper			Y							
SC Ring										
Insulating Material			Y							
Tubes for Cooler		Y								
Sleeve Bearing		Y								
Stator/Rotor, Exciter Coils										
Castings, stator frame, terminal box and bearing housing etc.										
Fabrication & machining of stator, rotor, terminal box										
Wound stator										
Wound Exciter										
Rotor complete				Y	Y					
Exciter, Stator, Rotor, Terminal Box assembly										
Accessories, RTD, BTD, CT, , Space heater, antifriction bearing, gaskets etc.										
Complete Motor						Y	Y	Y	Y1	Y

Note: 1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, No QP for LT motor upto 50KW.
 2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard
 3. Makes of major bought out items for HT motors will be subject to NTPC approval.
 Y1 = for HT Motor / Machines only.



TITLE:
**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-405-100-N001**
SECTION: **I**
SUB-SECTION: **IC**
REV. NO. **01** DATE **07/07/2016**
SHEET **1** OF **1**


SUB-SECTION – IC


SPECIFIC TECHNICAL REQUIREMENTS (C&I)


**3X660 MW NORTH KARANPURA STPP
(UNIT NO. 1, 2 & 3)**


SCOPE OF C&I FOR MISC. PUMPS

1. For each HT drives vibration pad is to be provided by pump supplier for mounting of vibration block of size 40mmx40mmx40mm. A key slot (30mmx15mmx3 mm) is to be provided on the drive shaft for phase marker.
2. RTD with thermo-well shall be provided for bearing temperature measurement by bidder.
3. The make/model of various instruments/items/systems shall be as per NTPC approved vendor list. No commercial and delivery implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
4. Termination of cable from RTD with thermo-well to TB(Mounted on pump, TB in bidder scope) shall be in bidder scope.
5. The specifications for instruments mentioned in the specification are minimum requirements. The detail specifications shall be finalized during detail engineering.
6. The bidders shall specifically mention any deviation they would like to take on the C&I specification. In absence of only deviation a No deviation certificate is to be furnished.
7. Bidder to perform tests of C&I items/instruments/systems as per Quality plans/type test attached in the specification. However, if any test not specified in the quality plan but specified in specification Tests for I&C equipment included elsewhere in specification will have to perform by Bidder without any cost implication.
8. Instrument installation and accessories required for the same shall be in Bidder's scope and shall be submitted after award of contract. However any instrument/ analyzer installation not covered in the same shall be subject to customer and BHEL approval during detailed engineering.
9. In addition to requirements specified here, all C&I systems/ sub-systems/ equipment/ devices shall also meet other requirements stipulated under other Sub-sections/ parts/ sections of specification.
10. Bidder shall supply any other instrument/Equipment required for proper functioning of the Pump system, as deemed necessary during contract without any price implication to BHEL.

CLAUSE NO.	TECHNICAL REQUIREMENTS																													
	<p>4 Sheathing of Thermocouple</p> <p>5 Calibration and accuracy</p> <p>6 Characteristic</p> <p>7 Accessories</p> <p>8 Standard</p>	<p>: Swaged type magnesium oxide insulation.</p> <p>: As per IEC-751/ANSI-C-96.1(special class) for T/C.</p> <p>: Linear with respect to temp, within $\pm 1/2$ percent of top range value.</p> <p>: Thermo well (as specified below) and shall be spring loaded for positive contacts with the well.</p> <p>: ANSI C 96.1 for Thermocouple and ASME PTC-19.3 for Thermo-well.</p>																												
3.02.00	Resistance Temperature Detector (RTD)																													
	<table border="1"> <thead> <tr> <th data-bbox="343 846 438 920">Sr. No.</th> <th data-bbox="438 846 853 920">Features</th> <th data-bbox="853 846 1310 920">Essential/Minimum Requirements</th> </tr> </thead> <tbody> <tr> <td data-bbox="343 949 438 987">1</td> <td data-bbox="438 949 853 987">Type of RTD.</td> <td data-bbox="853 949 1310 987">: Four wire, Pt-100 (100 Ohms resistance at zero degree Centigrade).</td> </tr> <tr> <td data-bbox="343 1048 438 1086">2</td> <td data-bbox="438 1048 853 1086">No. of element</td> <td data-bbox="853 1048 1310 1086">: Duplex</td> </tr> <tr> <td data-bbox="343 1122 438 1160">3</td> <td data-bbox="438 1122 853 1160">Housing/Head</td> <td data-bbox="853 1122 1310 1160">: IP-65/Diecast Aluminium. Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter (as applicable). Plug in connectors are to be provided for external signal cable connection.</td> </tr> <tr> <td data-bbox="343 1352 438 1391">4</td> <td data-bbox="438 1352 853 1391">Sheathing of RTD</td> <td data-bbox="853 1352 1310 1391">: Metal sheathed, ceramic packed</td> </tr> <tr> <td data-bbox="343 1426 438 1464">5</td> <td data-bbox="438 1426 853 1464">Calibration and accuracy</td> <td data-bbox="853 1426 1310 1464">: As per DIN-43760 Class-A for RTD</td> </tr> <tr> <td data-bbox="343 1500 438 1538">6</td> <td data-bbox="438 1500 853 1538">Characteristic</td> <td data-bbox="853 1500 1310 1538">: Linear with respect to temp, within $\pm 1/2$ percent of top range value.</td> </tr> <tr> <td data-bbox="343 1597 438 1635">7</td> <td data-bbox="438 1597 853 1635">Accessories</td> <td data-bbox="853 1597 1310 1635">: Thermo well (as specified below) and shall be spring loaded for positive contacts with the well.</td> </tr> <tr> <td data-bbox="343 1731 438 1769">8</td> <td data-bbox="438 1731 853 1769">Standard</td> <td data-bbox="853 1731 1310 1769">: DIN-43760 for RTD and ASME PTC-19.3 for Thermo-well.</td> </tr> </tbody> </table>	Sr. No.	Features	Essential/Minimum Requirements	1	Type of RTD.	: Four wire, Pt-100 (100 Ohms resistance at zero degree Centigrade).	2	No. of element	: Duplex	3	Housing/Head	: IP-65/Diecast Aluminium. Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter (as applicable). Plug in connectors are to be provided for external signal cable connection.	4	Sheathing of RTD	: Metal sheathed, ceramic packed	5	Calibration and accuracy	: As per DIN-43760 Class-A for RTD	6	Characteristic	: Linear with respect to temp, within $\pm 1/2$ percent of top range value.	7	Accessories	: Thermo well (as specified below) and shall be spring loaded for positive contacts with the well.	8	Standard	: DIN-43760 for RTD and ASME PTC-19.3 for Thermo-well.		
Sr. No.	Features	Essential/Minimum Requirements																												
1	Type of RTD.	: Four wire, Pt-100 (100 Ohms resistance at zero degree Centigrade).																												
2	No. of element	: Duplex																												
3	Housing/Head	: IP-65/Diecast Aluminium. Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter (as applicable). Plug in connectors are to be provided for external signal cable connection.																												
4	Sheathing of RTD	: Metal sheathed, ceramic packed																												
5	Calibration and accuracy	: As per DIN-43760 Class-A for RTD																												
6	Characteristic	: Linear with respect to temp, within $\pm 1/2$ percent of top range value.																												
7	Accessories	: Thermo well (as specified below) and shall be spring loaded for positive contacts with the well.																												
8	Standard	: DIN-43760 for RTD and ASME PTC-19.3 for Thermo-well.																												
<p>NORTH KARANPURA STPP (3X660 MW) EPC PACKAGE</p>	<p>TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.:CS-4410-001-2</p>	<p>SUB-SECTION-IIIC-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY)</p>	<p>PAGE 6 OF 36</p>																											

CLAUSE NO.	TECHNICAL REQUIREMENTS																											
	<p>NOTES :</p> <p>1) The specifications for RTDs of winding/ bearings of motor/pump, can be as per their manufacturer standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice. However the type of RTD shall be Pt100.</p> <p>2) The specifications of temp elements for air conditioning & ventilation system / process can be as per system manufacturer's standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice.</p>																											
3.03.00	<p>Metal Temperature Thermocouples</p> <table border="0" data-bbox="343 649 1452 1590"> <tr> <td>Measuring Medium</td> <td>Metal Temperature</td> </tr> <tr> <td>Material of Thermocouple.</td> <td>Chromel Alumel Type K</td> </tr> <tr> <td>Type of Thermocouple</td> <td>Duplex with separate hot junctions, ungrounded</td> </tr> <tr> <td>Insulation</td> <td>Mineral Insulation Magnesium Oxide.</td> </tr> <tr> <td>Thermocouple wire gauge</td> <td>16 AWG</td> </tr> <tr> <td>Protective sheath</td> <td>SS 321</td> </tr> <tr> <td>Protective sheath dia</td> <td>8 mm O.D</td> </tr> <tr> <td>Characteristics of Thermocouple</td> <td>Special limits of error as in ANSI thermocouple MC 96.01, 1975</td> </tr> <tr> <td>Mounting accessories</td> <td>1/2" BSP SS sliding end connector, weld pad, clamps of heat resistant steel SS310.</td> </tr> <tr> <td>Cold end sealing</td> <td>SS pot weal with colour coded PTFE headed sleeve Insulated flexible tails. Sealing compound- Epoxy resin.</td> </tr> <tr> <td>Minimum bending radius</td> <td>30 mm</td> </tr> <tr> <td>Length of T/C</td> <td>30 Mtr. (minimum)</td> </tr> </table> <p>Notes :</p> <p>1) The specification for thermocouples of bearings metal temp measurements can be as per their manufacturer standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice. However type of thermocouples shall be K-type.</p>				Measuring Medium	Metal Temperature	Material of Thermocouple.	Chromel Alumel Type K	Type of Thermocouple	Duplex with separate hot junctions, ungrounded	Insulation	Mineral Insulation Magnesium Oxide.	Thermocouple wire gauge	16 AWG	Protective sheath	SS 321	Protective sheath dia	8 mm O.D	Characteristics of Thermocouple	Special limits of error as in ANSI thermocouple MC 96.01, 1975	Mounting accessories	1/2" BSP SS sliding end connector, weld pad, clamps of heat resistant steel SS310.	Cold end sealing	SS pot weal with colour coded PTFE headed sleeve Insulated flexible tails. Sealing compound- Epoxy resin.	Minimum bending radius	30 mm	Length of T/C	30 Mtr. (minimum)
Measuring Medium	Metal Temperature																											
Material of Thermocouple.	Chromel Alumel Type K																											
Type of Thermocouple	Duplex with separate hot junctions, ungrounded																											
Insulation	Mineral Insulation Magnesium Oxide.																											
Thermocouple wire gauge	16 AWG																											
Protective sheath	SS 321																											
Protective sheath dia	8 mm O.D																											
Characteristics of Thermocouple	Special limits of error as in ANSI thermocouple MC 96.01, 1975																											
Mounting accessories	1/2" BSP SS sliding end connector, weld pad, clamps of heat resistant steel SS310.																											
Cold end sealing	SS pot weal with colour coded PTFE headed sleeve Insulated flexible tails. Sealing compound- Epoxy resin.																											
Minimum bending radius	30 mm																											
Length of T/C	30 Mtr. (minimum)																											
3.04.00	<p>Thermo well (for all process temp. elements)</p>																											
<p>NORTH KARANPURA STPP (3X660 MW) EPC PACKAGE</p>	<p>TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.:CS-4410-001-2</p>	<p>SUB-SECTION-IIIC-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY)</p>	<p>PAGE 7 OF 36</p>																									

CLAUSE NO.	TECHNICAL REQUIREMENTS																	
	<p>(a) Shall be one piece solid bored type of 316 SS of step-less tapered design. (As per ASME PTC 19.3, 1974)</p> <p>(b) For Mill classifier outlet long life solid sintered tungsten carbide material of high abrasion resistance shall be provided.</p> <p>(c) For Air & Flue gas 316 SS protecting tube with welded cap. (However contractor shall provide better material for Flue gas service if required based on the specified boiler design parameters).</p> <p>(d) For furnace zone, impervious ceramic protecting tube of suitable material along with Incoloy supporting tubes and adjustable flanges.</p>																	
3.05.00	<p>Cold Junction Compensation (CJC) Boxes</p> <table border="0"> <tr> <td>a) Ref. temp.</td> <td>60°C ± 1.3 °C for type K Thermocouple 60°C ± 2°C for type R Thermocouple</td> </tr> <tr> <td>b) Effect of ambient temp. variation</td> <td>± 0.1% per 10°C</td> </tr> <tr> <td>c) Material</td> <td>4 mm thick fiberglass reinforced polyester with Polyurethane paint & glazed finish.</td> </tr> <tr> <td>d) Protection class</td> <td>IP 55</td> </tr> <tr> <td>e) Cable entry</td> <td>Bottom with gland plates suitable for cables used along with blanking facility.</td> </tr> <tr> <td>f) Temp. control</td> <td>Automatic with remote temperature monitoring.</td> </tr> <tr> <td>g) Power supply</td> <td>24 V DC.</td> </tr> </table>			a) Ref. temp.	60°C ± 1.3 °C for type K Thermocouple 60°C ± 2°C for type R Thermocouple	b) Effect of ambient temp. variation	± 0.1% per 10°C	c) Material	4 mm thick fiberglass reinforced polyester with Polyurethane paint & glazed finish.	d) Protection class	IP 55	e) Cable entry	Bottom with gland plates suitable for cables used along with blanking facility.	f) Temp. control	Automatic with remote temperature monitoring.	g) Power supply	24 V DC.	
a) Ref. temp.	60°C ± 1.3 °C for type K Thermocouple 60°C ± 2°C for type R Thermocouple																	
b) Effect of ambient temp. variation	± 0.1% per 10°C																	
c) Material	4 mm thick fiberglass reinforced polyester with Polyurethane paint & glazed finish.																	
d) Protection class	IP 55																	
e) Cable entry	Bottom with gland plates suitable for cables used along with blanking facility.																	
f) Temp. control	Automatic with remote temperature monitoring.																	
g) Power supply	24 V DC.																	
3.06.00	<p>TEMPERATURE TRANSMITTER</p> <p>Following types of 2-wire temperature transmitter (directly powered from 4-20mA input cards of DDCMIS/PLC) shall be provided. The temperature transmitter shall be fully compatible with thermocouples and RTDs being provided by the contractor as well as Employer. Temperature compensation of the thermocouples shall be performed in the temperature transmitter itself.</p> <p>a. Single Input Head mounted Temperature Transmitter</p> <p>These shall be suitable for mounting in the head of temperature element itself. The protection class of head of thermo well along with its plug-in connector shall be min. IP65.</p> <p>b. Single Input DIN-rail mounted Temperature Transmitter</p> <p>These shall be suitable for mounting on DIN-rails in JB's. The specifications of the JB's shall be same as indicated in Subsection INST CABLE with additional DIN-rails and IP 65 Protection class . This temperature transmitter shall be the ones which are especially designed for DIN-rail mounting with IP 20 protection class. These shall have terminals for input/output provided on front side when mounted on DIN-rail.</p>																	
<p>NORTH KARANPURA STPP (3X660 MW) EPC PACKAGE</p>	<p>TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.:CS-4410-001-2</p>	<p>SUB-SECTION-IIIC-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY)</p>	<p>PAGE 8 OF 36</p>															

CLAUSE NO.	TECHNICAL REQUIREMENTS						
3.00.00	TYPE TEST REQUIREMENT FOR C&I SYSTEMS						
	Sl. No	Item Test	Requirement	Standard Test	To Be Specifically Conducted	NTPC's Approval Req. On Test Certificate	
	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	
	1	Elect. Metering instruments	As per standard (col 4)	IS-1248	No	Yes	
	2	Transducers	As per standard (col 4)	IEC-60688, IS12784	No	Yes	
	3	Thermocouple	Degree of protection test	IS-13947	No	No	
	4	RTD	As per standard (col 4)	IEC-60751	No	No	
	5	Electronic transmitter	As per standard (col 4)	BS-6447 / IEC-60770	No	Yes	
	6	E/P converter	As per standard (col 4)	Mfr. standard	No	Yes	
	7	Dust emission monitor	Degree of protection test	IS-13947	No	Yes	
	8	Instrumentation Cables Twisted & Shielded*					
	-Conductor		Resistance test	VDE-0815	No	Yes	
			Diameter test	IS-10810	No	Yes	
			Tin Coating test (Persulphate test)	IS-8130	No	Yes	
	-Insulation		Loss of mass	VDE 0472	No	Yes	
			Ageing in air ovens**	VDE 0472	No	Yes	
NORTH KARANPURA STPP (3X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS-4410-001-2			SUB-SECTION-III-C-10 TYPE TEST REQUIREMENTS		PAGE 3 OF 9	



STANDARD CHECK LIST FOR C&I INSTRUMENTS

CHECK LIST FOR TEMPERATURE ELEMENT - RTD

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR TYPE MODEL No./TAG No. PROCESS CONNECTION	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
2	STABILITY	-do-	-do-	P	W	V	
3	INSULATION RESISTANCE	-do-	-do-	P	W	V	
4	ENCLOSURE CLASS	-do-	-do-	P	W	V	
5	RESPONSE TIME	-do-	-do-	P	W	V	
7	ACCURACY	-do-	-do-	P	W	V	
8	HYDROSTATIC TEST	-do-	-do-	P	W	V	
9	ELECTRICAL CHARACTERISTIC OF SENSOR (CONTINUITY OF T/C WIRES & INSULATION RESISTANCE OF RTD LEADS w.r.t. BODY	-do-	-do-	P	W	V	
10	TEMP CURVES / CHARTS			P	V	V	
11	AMBIENT TEMP. EFFECT CHECK	-do-	-do-	P	W	V	
12	HV TEST	-do-	-do-	P	W	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.
- IBR certificate to be provided, if applicable



TITLE:
**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-405-100-N001**
SECTION: **I**
SUB-SECTION: **ID**
REV. NO. **01** DATE **07/07/2016**
SHEET **1** OF **1**

SUB-SECTION – ID

DATASHEET-A

DATA SHEET - A											SPECIFICATION NO.:	PE-TS-405-100-N001,Rev-01
MISCELLANEOUS PUMPS (HORIZONTAL)											REV. NO.: 00	DATE : 04/07/2016
3x660 MW NORHT KARANPURA STPP, UNIT# 1,2 &3.											SECTION : I	SUB-SECTION : ID
PROJECT/PACKAGE		HORIZONTAL PUMPS (TYPE-II)					HORIZONTAL PUMPS (TYPE-I)					
Sl. No.	DESCRIPTION	DMCW TG AUX'S PUMPS	DMCW SG AUX'S PUMPS	ACW PUMPS	AHS COOLING PUMPS	APH/ESP WASH PUMP	CONDENSATE TRANSFER PUMP	SERVICE WATER PUMPS	HVAC M/U PUMP	ACW M/U PUMP	DM WATER M/UP PUMP	BOILER FILL PUMP
1.0	SERVICE											
1.1	Total no. of pumps for Project	9	6	9	2	2	3	4	2	3	4	2
1.2	No. of working & standby pumps	(2W+1S) per unit	(1W+1S) per unit	(2W+1S) per unit	(1W+1S) for station	(1W+1S) for station	(3W+0S) for station	(3W+1S) for station	(1W+1S) for station	(2W+1S) for station	(3W+1S) for station	(1W+1S) for station
1.3	Liquid Handled (ref. water analysis enclosed herein)	PH corrected DM Water	PH corrected DM Water	Clarified water	Clarified water	Clarified water	DM water	Clarified water	Clarified water	Clarified water	DM water	DM water
1.4	Location (Indoor / Outdoor)	Indoor	Indoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor
1.5	Duty	Continuous	Continuous	Continuous	Continuous	Intermittent	Intermittent	Continuous	Continuous	Continuous	Continuous	Intermittent
1.6	No. of pumps working in parallel	2	-	2	-	-	3	3	-	2	3	-
1.7	Specific gravity	1	1	1	1	1	1	1	1	1	1	1
1.8	System design pressure (kg/sqcm)	10	12	7.5	7.5	12	10	12	12	12	10	20
2.0	DESIGN PARAMETERS											
2.1	Design capacity each, M ³ /hr	1290	470	1735	820	840	335	185	130	125	70	140
2.2	Total dynamic head (MWC)	37	55	40	43	80	50	78	52	35	65	160
2.3	Suction Pressure(MWC)	25	25	Flooded Suction	Flooded Suction	Flooded Suction	Flooded Suction	Flooded Suction	Flooded Suction	Flooded Suction	Flooded Suction	Flooded Suction
2.4	Design Temperature (°C)	60	60	60	60	60	50	60	60	60	50	50
2.5	Maximum permissible speed of pump (RPM)	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
2.6	Max. limit on shut off head Corresponding to pump TDH (MWC) at 51.5 Hz	Not to exceed 68 MWC	Not to exceed 85 MWC	Not to exceed 60 MWC	Not to exceed 60 MWC	Not to exceed 100 MWC	Not to exceed 81 MWC	Not to exceed 100 MWC	Not to exceed 100 MWC	Not to exceed 100 MWC	Not to exceed 81 MWC	Not to exceed 200 MWC
2.7	Operating range	-----40-120% of design duty point flow-----										
2.8	Motor rating	Motor rating (at 50 deg. C ambient) shall be either 10% above the maximum power requirement at any condition of the entire characteristic curve of the pump (viz. 0-120%).										
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	Horizontal Centrifugal	Horizontal Centrifugal	Horizontal Centrifugal	Horizontal Centrifugal	Horizontal Centrifugal	Horizontal Centrifugal	Horizontal Centrifugal	Horizontal Centrifugal	Horizontal Centrifugal	Horizontal Centrifugal
3.2	Impeller type	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
3.3	Casing type	Axially/Radially Split type	Axially/Radially Split type	Axially/Radially Split type	Axially/Radially Split type	Axially/Radially Split type	Axially/Radially Split type	Axially/Radially Split type	Axially/Radially Split type	Axially/Radially Split type	Axially/Radially Split type	Axially/Radially Split type
3.4	Coupling type	Spacer type	Spacer type	Spacer type	Spacer type	Spacer type	Spacer type	Spacer type	Spacer type	Spacer type	Spacer type	Spacer 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	Gland packing	Gland packing	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	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	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	ASTM A-351 CF8M	ASTM A-351 CF8M	2.5% Ni Cl to IS 210 Gr. FG 260	2.5% Ni Cl to IS 210 Gr. FG 260	2.5% Ni Cl to IS 210 Gr. FG 260	ASTM A-351 CF8M	2.5% Ni Cl to IS 210 Gr. FG 260	2.5% Ni Cl to IS 210 Gr. FG 260	2.5% Ni Cl to IS 210 Gr. FG 260	ASTM A-351 CF8M	ASTM A-351 CF8M
4.2	Impeller	ASTM A-351 CF8M	ASTM A-351 CF8M	Bronze to IS 318 Gr. I/II or SS316	Bronze to IS 318 Gr. I/II or SS316	Bronze to IS 318 Gr. I/II or SS316	ASTM A-351 CF8M	Bronze to IS 318 Gr. I/II or SS316	Bronze to IS 318 Gr. I/II or SS316	Bronze to IS 318 Gr. I/II or SS316	ASTM A-351 CF8M	ASTM A-351 CF8M
4.3	Shaft	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316
4.4	Shaft Sleeves	SS-410	SS-410	SS-410	SS-410	SS-410	SS-410	SS-410	SS-410	SS-410	SS-410	SS-410
4.5	Impeller Wearing rings	SS-316	SS-316	High leaded Bronze to IS-318 Gr.V/ SS-316 (in case of SS impeller)	High leaded Bronze to IS-318 Gr.V/ SS-316 (in case of SS impeller)	High leaded Bronze to IS-318 Gr.V/ SS-316 (in case of SS impeller)	SS-316	High leaded Bronze to IS-318 Gr.V/ SS-316 (in case of SS impeller)	High leaded Bronze to IS-318 Gr.V/ SS-316 (in case of SS impeller)	High leaded Bronze to IS-318 Gr.V/ SS-316 (in case of SS impeller)	SS-316	SS-316
4.6	Wetted fasteners	SS	SS	SS	SS	SS	SS	SS	SS	SS	SS	SS
4.7	Fasteners (others)	SS	SS	SS	SS	SS	SS	SS	SS	SS	SS	SS
4.8	Gland/Seal Cover	ASTM A-351 CF8M	ASTM A-351 CF8M	2.5% Ni Cl to IS 210 Gr. FG 260	2.5% Ni Cl to IS 210 Gr. FG 260	2.5% Ni Cl to IS 210 Gr. FG 260	SS 316	2.5% Ni Cl to IS 210 Gr. FG 260	2.5% Ni Cl to IS 210 Gr. FG 260	2.5% Ni Cl to IS 210 Gr. FG 260	SS 316	SS 316
4.9	Lantern Ring	SS 316	SS 316	Bronze	Bronze	Bronze	SS 316	Bronze	Bronze	Bronze	SS 316	SS 316
4.10	Mech. seal	Manufacturer standard	Manufacturer standard	-	-	-	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	PTFE/ Grafoil	PTFE/ Grafoil	PTFE/ Grafoil
4.12	Base Plate	MS fabricated IS-2062 (min. thk.-10 mm) Epoxy Coated										
4.13	Stuffing Box	ASTM A-351 CF8M	ASTM A-351 CF8M	2.5% Ni Cl to IS 210 Gr. FG 260	2.5% Ni Cl to IS 210 Gr. FG 260	2.5% Ni Cl to IS 210 Gr. FG 260	ASTM A-351 CF8M	2.5% Ni Cl to IS 210 Gr. FG 260	2.5% Ni Cl to IS 210 Gr. FG 260	2.5% Ni Cl to IS 210 Gr. FG 260	ASTM A-351 CF8M	ASTM A-351 CF8M
4.14	Casing Wearing rings (If applicable)	SS 316	SS 316	High leaded Bronze to IS-318 Gr.V/ SS-316 (in case of SS impeller)	High leaded Bronze to IS-318 Gr.V/ SS-316 (in case of SS impeller)	High leaded Bronze to IS-318 Gr.V/ SS-316 (in case of SS impeller)	SS 316	High leaded Bronze to IS-318 Gr.V/ SS-316 (in case of SS impeller)	High leaded Bronze to IS-318 Gr.V/ SS-316 (in case of SS impeller)	High leaded Bronze to IS-318 Gr.V/ SS-316 (in case of SS impeller)	SS 316	SS 316
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	SA312 TP304(ERW)	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	SA312 TP304(ERW)	SA312 TP304(ERW)
5.0	MANDATORY SPARES											
5.1	Fasteners	1 Set	1 Set of each type and size	1 Set	1 Set	NA	NA	NA	NA	NA	NA	NA



DATA SHEET - A

SPECIFICATION NO.:

PE-TS-405-100-N001,Rev-01

MISCELLANEOUS PUMPS (HORIZONTAL)

REV. NO.: 00


DATE : 04/07/2016

3x660 MW NORHT KARANPURA STPP, UNIT# 1,2 &3.


SECTION : I


SUB-SECTION : ID

PROJECT/PACKAGE		HORIZONTAL PUMPS (TYPE-II)						HORIZONTAL PUMPS (TYPE-I)				
Sl. No.	DESCRIPTION	DMCW TG AUX'S PUMPS	DMCW SG AUX'S PUMPS	ACW PUMPS	AHS COOLING PUMPS	APH/ESP WASH PUMP	CONDENSATE TRANSFER PUMP	SERVICE WATER PUMPS	HVAC M/U PUMP	ACW M/U PUMP	DM WATER M/UP PUMP	BOILER FILL PUMP
5.2	Sleeve nuts & O Rings	1 Set	1 Set of each type and size	1 Set	1 Set	NA	NA	NA	NA	NA	NA	NA
5.3	Gland & Gland Packing (if Applicable)	NA	2 Sets of each type and size	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.4	Gland Packing	2 Sets	NA	2 Sets	2 Sets	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set
5.5	Impeller	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.6	Impeller with Nuts	NA	NA	NA	NA	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.	1 No.
5.7	Bearings for the pumps	2 Sets	2 Sets of each type	2 Sets	2 Sets	NA	NA	NA	NA	NA	NA	NA
5.8	Bearing for the Pumps & Drives	NA	NA	NA	NA	2 Sets	2 Sets	2 Sets	2 Sets	2 Sets	2 Sets	2 Sets
5.9	Shafts	NA	1 No	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.10	Shafts with Fasteners	NA	NA	NA	NA	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set
5.11	Thrust Bearings (if applicable)	2 Sets	2 Sets of each type and size	2 Sets	2 Sets	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set
5.12	Shaft sleeve	1 Set	2 Nos.	1 Set	1 Set	2 Sets	2 Sets	2 Sets	2 Sets	2 Sets	2 Sets	2 Sets
5.13	Complete coupling (Pump & Motors)	1 Set	1 Set of each type and size	1 Set	1 Set	NA	NA	NA	NA	NA	NA	NA
5.14	Pump & Drive Coupling with all fastenres & Coupling Guard	NA	NA	NA	NA	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set
5.15	Casing Wearing rings (if applicable)	2 Sets	2 sets	2 Sets	2 Sets	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set
5.16	Impeller Wearing rings (If applicable)	2 Sets	2 sets	2 Sets	2 Sets	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set
5.17	Mechanical Seals (If applicable)	NA	1 Set of each type and size	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.18	Mechanical Seals (both DE and NDE)	1 Set	NA	1 Set	1 Set	NA	NA	NA	NA	NA	NA	NA
5.19	Set of impeller for each type of pump	1 Set	NA	1 Set	1 Set	NA	NA	NA	NA	NA	NA	NA
5.20	Pump shaft for each type of pump	1 Set	NA	1 Set	1 Set	NA	NA	NA	NA	NA	NA	NA
5.21	All Gaskets	NA	NA	NA	NA	1Set	1Set	1Set	1Set	1Set	1Set	1Set
5.22	All shaft couplings with fastners (as applicable).	NA	NA	NA	NA	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set
5.23	Pin and Bushes for the all Coupling as applicable.	NA	NA	NA	NA	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set	1 Set
5.24	Motor	NA	1 Set of each type	NA	NA	NA	NA	NA	NA	NA	NA	NA
5.25	Motor Bearings	NA	1 Set of each type	NA	NA	NA	NA	NA	NA	NA	NA	NA
6.0	BID EVALUATION RATE											
6.1	Bid evaluation rate	Rs.2.10 Lacs/KW	Rs.2.10 Lacs/KW	Rs.2.10 Lacs/KW	Rs.2.10 Lacs/KW	NA	NA	Rs.2.10 Lacs/KW	Rs.2.10 Lacs/KW	Rs.2.10 Lacs/KW	Rs.2.10 Lacs/KW	NA
6.2	Maximum permissible efficiency for Bid evaluation											
6.2.1	Pump Efficiency	85	83	86	84	NA	NA	80	79	84	70	NA
6.2.2	Motor Efficiency	93	94.9	93	95.3	NA	NA	94.5	92.9	91.8	92.7	NA
Notes :												
1	Material of construction for other components not specified above shall be similarly selected in line with the above for the duty intended and subject to approval.											
2	For items stated as not applicable by bidder, shall have to be supplied without any cost implication to BHEL in the event they are found to be applicable during detail engineering stage.											
3	For all HT motor driven pumps (wherever applicable), bidder shall provide flat surface with dimensions 60 MM x60 MM on bearing Housing for mounting vibration measuring block and a key slots of dimensions 30MM (L) X 15 MM (W) X 3 MM (D) on each pump shaft or some other suitable location which shall be confirmed during detail engineering by BHEL for Phase Marker.											
4	Wherever SS material is coming in contact with non SS material, suitable isolation (rubber etc.) shall be provided to avoid galvanic corrosion.											

		DATA SHEET - A	SPECIFICATION NO.:	PE-TS-405-100-N001,Rev-01
MISCELLANEOUS PUMPS (Vertical Type-I)		REV. NO.: 00	DATE : 04/07/2016	
3x660 MW NORHT KARANPURA STPP, UNIT# 1,2 &3.		SECTION : I	SUB-SECTION : ID	
VERTICAL PUMPS(TYPE-I)				
SI. No.	DESCRIPTION	PLANT POTABLE WATER PUMPS	COLLONY POTABLE WATER PUMP	
1.0	SERVICE			
1.1	Total no. of pumps for Project	2	2	
1.2	No. of working & standby pumps	(1W+1S) for Station	(1W+1S) for Station	
1.3	Liquid Handled (ref. water analysis enclosed herein)	Filtered water	Filtered water	
1.4	Location	Filtered water P/H	Filtered water P/H	
1.4.1	Indoor / Outdoor	Outdoor	Outdoor	
1.5	Duty	Intermittent	Intermittent	
1.6	No. of pumps working in parallel	-	-	
2.0	DESIGN PARAMETERS			
2.1	Design capacity each, M ³ /hr	25	130	
2.2	Total dynamic head (MWC) (Excluding Pumps Internal Losses for Vertical Pumps)	65	47	
2.3	• Suction Pressure(MWC)	Submerged Suction	Submerged Suction	
	• Floor Level- for Pump Mounting	0.0 M	0.0 M	
	• Min. W.L	EL (-1.5 M)	EL (-1.5 M)	
	• Max. W.L.	EL (-0.5 M)	EL (-0.5 M)	
	• Sump Invert Level	EL (-3.5 M)	EL (-3.5 M)	
	• Crane Hook Level	NA	NA	
	• Crane Capacity Available	NA	NA	
2.4	Design Temperature (°C)	50	50	
2.5	Maximum permissible speed of pump (RPM)	3000	1500	
2.6	Max. limit on shut off head Corresponding to pump TDH (MWC) at 51.5 Hz	Not to exceed 75 MWC	Not to exceed 55 MWC	
2.7	Pump Discharge - above floor / below floor	Above floor	Above floor	
2.8	Suction pipe (ODXTHK),(mmxmm)	-	-	
2.9	Discharge pipe (ODXTHK),(mmxmm)	89.5 x 4.8	219.0 X 6.0	
2.10	Operating range	40-120% of design duty point		
2.11	Motor rating	Continuous motor rating (at 50 OC ambient) for all pumps shall be at least 10% above the max. power requirement at any condition of the entire characteristic curve of the pump (viz; 0-120% flow).		
2.12	Permissible tolerance in rated capacity & TDH	No negative tolerance		
2.13	Permissible tolerance in efficiency at rated capacity(%)	No negative tolerance		
2.14	Performance/Design Standard	HIS		
3.0	CONSTRUCTION FEATURES			
3.1	Pump type	Vertical	Vertical	
3.2	Impeller type	Closed	Closed	
3.3	Casing type	Preferable Vertical turbine type.If stages are more than 5, then sump pump construction may be offered.		
3.4	Coupling type	Flexible	Flexible	
3.5	Sealing arrangement	Self Water/Gland	Self Water/Gland	
3.6	Type of Lubrication	Oil/ Grease/ Self Water	Oil/ Grease/ Self Water	
3.7	Pump characteristics	Non Overloading type & stable	Non Overloading type & stable	
3.8	Drain Plugs, vent, lifting lugs, etc.	Required	Required	
4.0	MATERIALS OF CONSTRUCTION			
4.1	Casing & Suction Bell	2.5% Ni Cl to IS 210 Grade FG 260	2.5% Ni Cl to IS 210 Grade FG 260	
4.2	Column Pipe (Only In Case of Vertical Pump)	MS FAB. IS-2062	MS FAB. IS-2062	
4.3	Minimum column pipe thickness, mm	6 mm	6 mm	
4.4	Impeller	ASTM -A351- CF8M	ASTM -A351- CF8M	
4.5	Shaft	SS-410	SS-410	
4.6	Shaft Sleeves	SS-304	SS-304	
4.7	Wearing rings	SS-316	SS-316	
4.8	Wetted fasteners	SS-304	SS-304	
4.9	Fasteners (others)	SS-304	SS-304	
4.10	Gland	2.5% Ni Cl to IS 210 grade FG 260	2.5% Ni Cl to IS 210 grade FG 260	
4.11	Lantern Ring	SS-316	SS-316	
4.12	Intermediate stage bearings	-	-	
4.13	Mech. seal	N/A	N/A	

4.14	Gland Packing (Asbestos Free)	PTFE/ Grafoil	PTFE/ Grafoil
4.15	Base Plate	Fabricated Steel to IS 2062 with epoxy coated (minimum 10 mm	
4.16	Connecting Pipe 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 -		
5.1	Shaft sleeve	2 Sets	2 Sets
5.2	Bearings of pumps (all bearing) including thrust bearing as applicable.	1 Set	1 Set
5.3	Bearings of motor (all bearing including thrust bearing as applicable.	1 Set	1 Set
5.4	Wearing ring or equivalent for impeller(if applicable)	1 Set	1 Set
5.5	Wearing ring or equivalent for Casing/Bowl(if applicable)	1 Set	1 Set
5.6	Impeller Shaft and line shafts with fasteners (as applicable)	1 Set	1 Set
5.7	All shaft couplings with fasteners (as applicable)	1 Set	1 Set
5.8	Coupling between pump and motor & coupling Guards	1 Set	1 Set
5.9	Bushes for the eall Coupling as applicable	1 Set	1 Set
5.1	Gland Packing	1 Set	1 Set
5.11	Thrust Bearing Pads (if applicable)	2 Sets	2 Sets
5.12	All Gaskets	1 Set	1 Set
5.13	Impeller with Impeller nut	1 Set	1 Set
6.0	Bid Evaluation		
6.1	Bid evaluation rate	NA	NA
6.2	Maximum permissible efficiency for Bid evaluation		
6.2.1	Pump Efficiency	NA	NA
6.2.2	Motor Efficiency	NA	NA
Notes :			
1	Material of construction for other components not specified above shall be similarly selected in line with the above for the duty intended and subject to approval.		
2	For items stated as not applicable by bidder, shall have to be supplied without any cost implication to BHEL in the event they are found to be applicable during detail engineering stage.		
3	For all HT motor driven pumps (wherever applicable), bidder shall provide flat surface with dimensions 60 MM x60 MM on bearing Housing for mounting vibration measuring block and a key slots of dimensions 30MM (L) X 15 MM (W) X 3 MM (D) on each pump shaft or some other suitable location which shall be confirmed during detail engineering by BHEL for Phase Marker..		
4	Wherever SS material is coming in contact with non SS material, suitable isolation (rubber etc.) shall be provided to avoid galvanic corrosion.		

CLAUSE NO.	MANDATORY SPARES			
	<p>GENERAL NOTE:</p> <p>1. Unless stated otherwise a 'set' (marked by **), it will include the total requirement of the item for a unit module or the station as specified. Where it is specified as "set" (marked by *) it would mean the requirement for the single equipment/system as the case may be. Also are set for the particular equipment e.g. 'set' of bearings for a pump would include the total number of bearings in a pump. Also the 'set' would include all components required to replace the item; for example a set of bearing shall include all hardware normally required while replacing the bearings. It is further, intended that the assembly/sub-assembly which have different orientation (like left hand or right hand, top or bottom), different direction of rotation or mirror image positioning or any other reasons which result in maintaining two different sets of the spares to be used for the subject assembly/sub-assembly, these shall be considered as different types of assembly/sub-assembly.</p>			
<p>NORTH KARANPURA STPP (3X660 MW) EPC PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION-VI, PART-F BID DOC. NO. CS-4410-001-2</p>	<p>MANDATORY PARES CHAPTER-02 TURBINEGENERATOR</p>	<p>PAGE 1 of 2</p>	

CLAUSE NO.	MANDATORY SPARES			
	<p>2. Wherever quantity has been specified as percentage (%), it shall mean percentage (%) of the total population of the item in the station (project), unless specified otherwise and the fraction will be rounded off to the next higher whole number.</p> <p>3. Wherever the quantities have been indicated for each type, size, thickness, material, radius, range etc. these shall cover all the items supplied and installed and the break up for these shall be furnished in the bid.</p> <p>4. In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed in the above list.</p> <p>5. Interchangeability and Packings: All spares supplied under this contract shall be strictly interchangeable with parts for which they are intended for replacements. These spares should include all mounted accessories like components, boards, add or items, fitting, connectors etc. and be complete in all respects so that the replacement of the main items by these spares does not require any additional item. The vendors must conform the pair to pair compatibility of each electrical spares modules with the modules should be supplied in the original package. All electronic modules should be pre set and/or preprogrammed for ready use at site. Alternatively, suitable instruction sheet indicating the details of required PCB jumper position, BCD which is setting, EPROM/PROM listing etc should be packed along with each module. Also a caution mark sign should be put on all such module which needs pre setting/pre programming before putting them in to service. The spare shall be treated and properly packed for long term storage</p> <p>6. Identification: Each spare shall be clearly marked and labeled on the outside of the packing with its description. When more than one spare part is packed in single case, a general description of the contents shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification.</p>			
<p align="center">NORTH KARANPURA STPP (3X660 MW) EPC PACKAGE</p>	<p align="center">TECHNICAL SPECIFICATION SECTION-VI, PART-F BID DOC. NO. CS-4410-001-2</p>	<p align="center">MANDATORY PARES CHAPTER-02 TURBINEGENERATOR</p>	<p align="center">PAGE 2 of 2</p>	

CLAUSE NO.

PROJECT INFORMATION



Annexure-III

RAW WATER ANALYSIS

Sl. No.	Constituent	as	mg per litre
1.	Calcium	CaCO ₃	65
2.	Magnesium	CaCO ₃	41
3.	Sodium	CaCO ₃	98
4.	Potassium	CaCO ₃	5
5.	Total Cations	CaCO ₃	209
6.	Total Alkalinity	CaCO ₃	150
7.	Chloride	CaCO ₃	25
8.	Sulphate	CaCO ₃	34
9.	Total Anions	CaCO ₃	209
9.	Silica (Reactive)	SiO ₂	9
11.	Iron	Fe	1.2
12.	pH Value	-	7.6-8.2
13.	Turbidity	NTU	200
14.	Organics(As per KMnO ₄ method)	Number	2



TITLE:
**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-405-100-N001**
SECTION: **II**
SUB-SECTION: **IIA**
REV. NO. **01** DATE **07/07/2016**
SHEET **1** OF **1**

SUB-SECTION - IIA

STANDARD TECHNICAL SPECIFICATION (MECHANICAL)

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



TITLE:
**STANDARD TECHNICAL SPECIFICATION
HORIZONTAL PUMPS**

SPECIFICATION NO. PES-179-06

VOLUME:

SECTION: IIA

REV. NO. 04

DATE: 01/07/2016

SHEET 1 of 16

1.00.00 GENERAL INFORMATION

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

2.00.00 CODES AND STANDARDS

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



TITLE:
**STANDARD TECHNICAL SPECIFICATION
HORIZONTAL PUMPS**

SPECIFICATION NO. PES-179-06

VOLUME:


SECTION: IIA

REV. NO. 04

DATE: 01/07/2016

SHEET 2 of 16

- 2.01.07 ISO 3555/1977: Acceptance test for centrifugal, mixed flow
BS 5316/1977 and axial flow pumps - Class 'B' tests.
Part 2
- 2.01.08 ISO 2548/1973: - Do - Class 'C' tests.
BS 5316/1976
Part 1
- 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.
- 3.00.00 SCOPE OF SUPPLY & SERVICES:**
- 3.01.00 The miscellaneous pumps and drives scope shall be as specified in Data Sheet A /Section IA.
- 3.02.00 The Capacity, Head, Materials of construction and other particulars of pumps are detailed in Data Sheet A of the specification.
- 3.03.00 Accessories:
- All the pumps under this specification shall be complete with following standard/special accessories.
- 3.03.01 Standard accessories:
- 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).
 - Pump motor coupling along with coupling guard.
 - Common base plate for pumps and motor.
 - Self contained lubrication system along with all internal piping, valves, fittings, specialties etc. as required.

	TITLE:	SPECIFICATION NO. PES-179-06
	STANDARD TECHNICAL SPECIFICATION HORIZONTAL PUMPS	VOLUME:
		SECTION: IIA
		REV. NO. 04 DATE: 01/07/2016
		SHEET 3 of 16
	<p>e) Counter flanges for suction/ discharge nozzles along with fixing nuts, bolts and gaskets.</p> <p>f) Anchor bolts, nuts, seating steel works, shims etc. as necessary for mounting the pump-motor unit on civil foundations.</p> <p>g) Suitable vent (with valves)/ lifting/ handling attachments for the pump/ motor/ accessories.</p> <p>h) Suitable drain connections with isolating valves as applicable.</p> <p>i) Supply of first fill of lubricants with toping requirements for one year of operation after commissioning and handing over of equipment.</p> <p>j) Set of “Special” Tools & Tackles for Pumps and motors, if any.</p> <p>k) Erection and commissioning spares, “on as required” basis.</p> <p>l) Bidder shall provide various drawings, data, calculations, test reports/ certificates, operation and maintenance manuals, As-built drawings, etc. as specified and as necessary.</p> <p>m) Mandatory spares as specified in respective Data Sheet-A of this section.</p> <p>3.04.00 Services included in Bidder’s Scope:</p> <p>3.04.01 The pumps shall be guaranteed to meet the performance requirements specified vide Data Sheet -A and also for trouble free operation after commissioning. Schedule of performance guarantees (Section-IIIA) duly filled and signed shall be furnished with the bid.</p> <p>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. 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.</p> <p>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.</p> <p>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 shall be conducted by pump vendor at project site to ensure that the pumps meet the specified requirements. Pump vendor shall bring necessary instruments for conductance of site performance test.</p>	



TITLE:

**STANDARD TECHNICAL SPECIFICATION
HORIZONTAL PUMPS**

SPECIFICATION NO. PES-179-06
VOLUME:
SECTION: IIA
REV. NO. 04 **DATE:** 01/07/2016
SHEET 4 of 16

If the site performance is found not meeting the requirements in any respect as specified, then the equipment shall be rectified or replaced by the vendor, without any commercial implication to BHEL

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

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

3.04.05 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.

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

- 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.



TITLE:
**STANDARD TECHNICAL SPECIFICATION
HORIZONTAL PUMPS**

SPECIFICATION NO. PES-179-06
VOLUME:
SECTION: IIA
REV. NO. 04 **DATE:** 01/07/2016
SHEET 5 of 16

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-I as well as Section-II. In the event of any contradiction of Section-II with Section-I, the Section-I will prevail.

5.02.00 The pumps shall be Electric motor driven.

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

5.04.00 The 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.



TITLE:
**STANDARD TECHNICAL SPECIFICATION
HORIZONTAL PUMPS**

SPECIFICATION NO. PES-179-06
VOLUME:
SECTION: IIA
REV. NO. 04 **DATE:** 01/07/2016
SHEET 6 of 16

- 5.07.00 The shut off head of pumps shall be more than pump rated TDH and percentage variation may vary depending on the specific speed of the pump as under:
- i. 10-15% for pumps of specific speed up to 1000 US units,
 - ii. 15-20% for pumps of specific speed in the range of 1000 to 2000 US units,
 - iii. 20-40% for pumps of specific speed in the range of 2000 to 4000 US units,
 - iv. Above 50% for pumps of specific speed in the range of 4000 to 7000 US units.
- 5.08.00 All HT motors and those LT motors which are not in bidder's scope of supply: bare motors only, shall be supplied as free issue by BHEL through BHEL, based on ratings and TS (Torque - Speed) curve selected and furnished by the bidders along with their un-priced bid. The responsibility for satisfactory operation for combined performance of pumps & motors shall rest with the bidder only as if, the drive motors also have been supplied by the bidder.
- Couplings, base plate, foundation bolts, any other fittings, etc. as required shall be supplied by the bidders only. BHEL shall supply one number of each type of drive motors (where drive motor is not in bidder's scope of supply) for shop testing of pumps with job motors. All other motors shall be dispatched by BHEL directly to project sites.
- 5.09.00 For all HT motor driven pumps, BHEL has envisaged vibration-monitoring system in their own scope. The bidder shall make provisions for mounting following on the pump/ pump shaft:
- Purchaser's probes in both DE/NDE bearings of pumps
 - Key slots on pump shaft and flat surface on bearing housing for mounting vibration measuring block with dimensions as specified in Data Sheet A.
 - Other components as finalized during detailing.
 - For mounting of above on the HT motors & specifically excluded LT motors, same shall be taken care by BHEL.
- 5.10.00 The pumps shall be capable of developing the required total head at rated capacity for continuous operation. The pumps shall operate satisfactorily at any point on the Q-H characteristic curve over a range of 0% to 130% capacity and shall be suitable for continuous operation between 30% to 130% capacity.
- 5.11.00 Selection of the pumps shall be such that the design point shall be met even with negative manufacturing tolerance.
- 5.12.00 The total head capacity curve shall be continuously rising towards the shut off, the pumps shall preferably be non-overloading type and stable.
- 5.13.00 The pumps shall be capable of running over the entire range of 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.

	TITLE:	SPECIFICATION NO. PES-179-06	
	STANDARD TECHNICAL SPECIFICATION HORIZONTAL PUMPS	VOLUME:	
		SECTION: IIA	
		REV. NO. 04	DATE: 01/07/2016
	SHEET 7 of 16		
5.14.00	<p>The pumps shall be of stiff shaft design. The minimum internal clearances should be sufficiently more than the maximum static deflection of the shaft. Shaft size selected must take into consideration the critical speed as specified in API-610.</p>		
5.15.00	<p>Pumps and motors shall run smooth without undue noise and vibration.</p> <p>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.</p> <p>The noise level shall be limited to 85 dB at distance of 1.0M.</p>		
5.16.00	<p>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.</p>		
5.17.00	<p>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.</p>		
5.18.00	<p>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.</p>		
5.19.00	<p>The offered pumps shall be of proven design meeting the experience-qualifying requirement of their operation at two sites for a minimum period of one year or as specified in technical PQR. Any deviation to this criterion shall be suitably highlighted in the deviations schedule.</p>		
5.20.00	<p>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.</p> <p>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.</p>		
6.00.00	MANDATORY SPARES:		
6.01.00	<p>Bidder to provide the Mandatory spares listed vide Data Sheet-A. Unit price of mandatory spares shall be furnished in price Schedule.</p>		
6.02.00	<p>Bidder shall include the cost of Mandatory Spares, unless specified otherwise in Sec-IA of the specification or NIT.</p>		



TITLE:
**STANDARD TECHNICAL SPECIFICATION
HORIZONTAL PUMPS**

SPECIFICATION NO. PES-179-06

VOLUME:

SECTION: IIA

REV. NO. 04

DATE: 01/07/2016

SHEET 8 of 16

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 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.



TITLE:
**STANDARD TECHNICAL SPECIFICATION
HORIZONTAL PUMPS**

SPECIFICATION NO. PES-179-06

VOLUME:

SECTION: IIA

REV. NO. 04

DATE: 01/07/2016

SHEET 9 of 16

8.00.00 PERFORMANCE REQUIREMENTS

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

8.02.00 Pump(s) shall preferably be designed to have the best efficiency at flow within $\pm 10\%$ 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 Section-I.

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

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

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

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

9.00.00 DESIGN AND CONSTRUCTION

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.

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.



TITLE:
**STANDARD TECHNICAL SPECIFICATION
HORIZONTAL PUMPS**

SPECIFICATION NO. PES-179-06
VOLUME:
SECTION: IIA
REV. NO. 04 **DATE:** 01/07/2016
SHEET 10 of 16

- 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 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 Bearing housing for HT motor driven pumps shall have provision for mounting temperature measuring device.



TITLE:
**STANDARD TECHNICAL SPECIFICATION
HORIZONTAL PUMPS**

SPECIFICATION NO. PES-179-06

VOLUME:

SECTION: IIA

REV. NO. 04

DATE: 01/07/2016

SHEET 11 of 16

- 9.06.07 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**
- 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.



TITLE:
**STANDARD TECHNICAL SPECIFICATION
HORIZONTAL PUMPS**

SPECIFICATION NO.	PES-179-06		
VOLUME:			
SECTION:	IIA		
REV. NO.	04	DATE:	01/07/2016
SHEET	12 of 16		

- a) 16% margin over the pump shaft input power at the rated duty point.
- b) 10% 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 random & independent PMI inspection on pump casing, shaft and impeller to ascertain the grade of material during inspection at vendor works.
- iii) Tests for each pump included under this section shall include but not be limited to the following:



TITLE:

**STANDARD TECHNICAL SPECIFICATION
HORIZONTAL PUMPS**

SPECIFICATION NO. PES-179-06	
VOLUME:	
SECTION: IIA	
REV. NO. 04	DATE: 01/07/2016
SHEET 13 of 16	

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

b) Hydraulic Testing

The pump casing 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 (or)
- iii. System Design pressure indicated in Data Sheet-A of Section-I.

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

c) Performance Test at Shop

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



TITLE:
**STANDARD TECHNICAL SPECIFICATION
HORIZONTAL PUMPS**

SPECIFICATION NO. PES-179-06
VOLUME:
SECTION: IIA
REV. NO. 04 **DATE:** 01/07/2016
SHEET 14 of 16

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

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

11.00.00 DRAWINGS/ DOCUMENTS DISTRIBUTION SCHEDULE

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

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

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

13.00.00 Bidder to submit all drawing/ documents in soft as well as hard copy in the event of order as per schedule indicated in section-IA.

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

Further on receipt of customer's comments on the documents a technical representative from Bidder's works shall come for meeting with Customer to resolve all issues and incorporate all comments in the soft copy here only and further resubmission of same to Customer. The representative shall be available here till Category-I approval of all the drawings and documents.



TITLE:
**STANDARD TECHNICAL SPECIFICATION
HORIZONTAL PUMPS**

SPECIFICATION NO. PES-179-06

VOLUME:

SECTION: IIA

REV. NO. 04

DATE: 01/07/2016

SHEET 15 of 16

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

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

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



TITLE:
**STANDARD TECHNICAL SPECIFICATION
HORIZONTAL PUMPS**

SPECIFICATION NO. PES-179-06

VOLUME:

SECTION: IIA

REV. NO. 04

DATE: 01/07/2016

SHEET 16 of 16

DATA SHEET – C

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

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

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

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

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

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

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

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

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

1.6 Operation and maintenance manual.

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

1.8 PG test procedure as per clause 3.04.04 (if applicable).

1.9 Motor type test document (if applicable).

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

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

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

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

4.0 Distribution of drawings / documents for all projects:

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



TITLE:
**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07
VOLUME:
SECTION: IIA
REV. NO. 04 **DATE:** 01/07/2016
SHEET 1 of 18

1.00.00 GENERAL INFORMATION

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

2.00.00 CODES AND STANDARDS

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



TITLE:
**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07

VOLUME:

SECTION: IIA

REV. NO. 04

DATE: 01/07/2016

SHEET 2 of 18

- 2.01.07 BS 5316 Acceptance tests for Centrifugal, mixed flow Part-I/1976 and axial flow pumps - Class 'C' Tests (ISO 2548/1973)
- 2.01.08 BS 5316 Acceptance tests for Centrifugal, mixed flow Part-II/1977 and axial flow pumps - Class 'B' Tests (ISO 3555/1977)
- 2.01.09 ANSI B 73.2M 1984 Vertical inline centrifugal pumps for chemical process
- 2.01.10 API-610/1989: Centrifugal pumps for general refinery services.
- 2.01.11 HIS Hydraulic Institute Standards, USA
- 2.01.12 PTC 8.2/1965: Power Test Codes - Centrifugal pumps.
- 2.01.13 ASTM-1-165-55 Standard Methods for Liquid Penetration Inspection.
- 2.02.00 In case of any contradiction with the above standards and annexure, the stipulations in the annexure shall prevail and shall be binding on the bidder.
- 3.00.00 SCOPE OF SUPPLY & SERVICES:**
- 3.01.00 The miscellaneous pumps and drives scope shall be as specified in Data Sheet-A /Section IA.
- 3.02.00 The Capacity, Head, Materials of construction and other particulars of pumps are detailed in Data Sheet-A of the specification.
- 3.03.00 Accessories:
- All the pumps under this specification shall be complete with following standard/special accessories.
- 3.03.01 Standard accessories:
- 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).
 - Pump motor coupling along with coupling guard.
 - Common base/sole plate for pumps and motor.
 - Thrust block assembly (Thrust pads, attachments) for transferring the pump thrust to concrete thrust block (concrete thrust block in purchaser scope), as per clause 5.23.00.



TITLE:
**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07

VOLUME:

SECTION: IIA

REV. NO. 04

DATE: 01/07/2016

SHEET 3 of 18

- e) Thrust bearing temperature measurement devise to be provided.
- f) Self contained lubrication system along with all internal piping, valves, fittings, specialties etc. as required.
- g) Counter flanges for suction/ discharge nozzles along with fixing nuts, bolts and gaskets.
- h) Anchor bolts, nuts, seating steel works, shims etc. as necessary for mounting the pump-motor unit on Civil foundations.
- i) Suitable vent (with valves)/ lifting/ handling attachments for the pump/ motor/ accessories.
- j) Suitable drain connections with isolating valves as applicable.
- k) Supply of first fill of lubricants with toping requirements for one year of operation after commissioning and handing over of equipment.
- l) Set of "Special" Tools & Tackles for Pumps and motors, if any.
- m) Erection and commissioning spares, "on as required" basis.
- n) Bidder shall provide various drawings, data, calculations, test reports/ certificates, operation and maintenance manuals, As-built drawings, etc. as specified and as necessary.
- o) Mandatory spares as specified in respective Data Sheet-A of this section.

3.04.00 Services included in Bidder's Scope:

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

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

3.04.03 After commissioning of pumps at site, site performance test for Noise, vibration and parallel running of pumps of all pumps for each unit/project shall be conducted by pump vendor at project site to ensure that the pumps meet the specified requirements. Pump vendor shall bring necessary instruments for conductance of site performance test. If the site performance is found not meeting the requirements in any respect as specified, then the equipment shall be rectified or replaced by the vendor, without any commercial implication to BHEL.



TITLE:

**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07
VOLUME:
SECTION: IIA
REV. NO. 04 **DATE:** 01/07/2016
SHEET 4 Of 18

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

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

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

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

4.00.00 BID EVALUATION CRITERIA & LIQUIDATED DAMAGES FOR SHORTFALL:

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

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

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

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

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

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



TITLE:
**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07	
VOLUME:	
SECTION: IIA	
REV. NO. 04	DATE: 01/07/2016
SHEET 5 of 18	

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

NOTE:

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

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

4.03.00 Liquidated damages for shortfall in Guaranteed KW

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

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

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

5.00.00 **TECHNICAL REQUIREMENTS:**

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

5.02.00 The pumps shall be Electric motor driven.

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

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

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



TITLE:
**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07
VOLUME:
SECTION: IIA
REV. NO. 04 **DATE:** 01/07/2016
SHEET 6 of 18

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



TITLE:
**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07

VOLUME:

SECTION: IIA

REV. NO. 04

DATE: 01/07/2016

SHEET 7 of 18

The prevailing suction pressures for various pumps are indicated in Data Sheet-A for suitable mechanical design of pumps.

5.14.00 The pumps shall be of stiff shaft design. The minimum internal clearances should be sufficiently more than the max. static deflection of the shaft. Shaft size selected must take into consideration the critical speed as specified in API-610.

5.15.00 Pumps and motors shall run smooth without undue noise and vibration.

The vibration shall be within vibration norms for testing as per American National Standard for 'Rotodynamics Pump' for Vibration Measurement and allowable values, Doc. ANSI/ HIS 9.6.4-2009. The applicable vibration limits for each pump, shall be indicated in the Technical Data sheet to be furnished by the successful bidder after award of LOI/ PO.

The noise level shall be limited to 85 dB at distance of 1.0M.

5.16.00 Pumps of a particular category shall be identical and shall be suitable for parallel operation with equal load division. Components of identical pumps shall be interchangeable.

5.17.00 After installation, the guaranteed values of noise, vibration and parallel operation of pumps shall be tested and verified. If the site performance is found not meeting the requirements in any respect as specified, then the equipment shall be rectified or replaced by the vendor, at his own cost.

5.18.00 High reliability of the pumps is an essential requirement and therefore it gets weightage over its efficiency. It is therefore essential that the bidder choose a standard proven model from the range of pumps manufactured.

5.19.00 The offered pumps shall be of proven design meeting the experience-qualifying requirement of their operation at two sites for a minimum period of one year or as specified in technical PQR. Any deviation to this criterion shall be suitably highlighted in the deviations schedule.

5.20.00 The bearings shall be self-water lubricated, no external water supply shall be available. The cooling/ lubrication water for bearings, etc. shall be tapped from the pump discharge and supplied thru' bidder's integral pipe work.

5.21.00 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.



TITLE:
**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07

VOLUME:

SECTION: IIA

REV. NO. 04

DATE: 01/07/2016

SHEET 8 of 18

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

5.21.02

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

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

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



TITLE:
**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07

VOLUME:

SECTION: IIA

REV. NO. 04

DATE: 01/07/2016

SHEET 9 of 18

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

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

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

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

6.00.00 MANDATORY SPARES:

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

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

7.00.00 OTHER REQUIREMENTS:

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

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



TITLE:
**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07

VOLUME:

SECTION: IIA

REV. NO. 04

DATE: 01/07/2016

SHEET 10 of 18

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, “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 Section-I.

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 Section-I.



TITLE:
**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07

VOLUME:

SECTION: IIA

REV. NO. 04

DATE: 01/07/2016

SHEET 11 of 18

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

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

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

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

9.00.00 **DESIGN AND CONSTRUCTION**

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

9.01.00 **Bowl Assembly**

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

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

9.02.00 **Discharge Head**

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

9.03.00 **Column pipe**

9.03.01 Column pipe shall be flanged and of bolted connection. Column pipes shall be designed for full internal vacuum.

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



TITLE:
**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07

VOLUME:

SECTION: IIA

REV. NO. 04

DATE: 01/07/2016

SHEET 12 of 18

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

9.04.00 Impeller shaft, line shaft and head shaft

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

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

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

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

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

9.05.00 Shaft enclosing tube

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

9.06.00 Seal rings

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

9.07.00 Bearings

9.07.01 Shaft bearings

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

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

9.07.02 Thrust Bearing



TITLE:
**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07

VOLUME:

SECTION: IIA

REV. NO. 04

DATE: 01/07/2016

SHEET 13 of 18

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

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

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

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

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

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

9.08.00 **Reverse Rotation**

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

9.09.00 **Drive Unit**

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

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

- a) 16% margin over the pump shaft input power at the rated duty point.
- b) 10% 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



TITLE:
**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07

VOLUME:

SECTION: IIA

REV. NO. 04

DATE: 01/07/2016

SHEET 14 of 18

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

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

10.00.00 **INSPECTION AND TESTING**

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

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

a) **Identification and Testing**

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

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

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

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

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



TITLE:
**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07	
VOLUME:	
SECTION: IIA	
REV. NO. 04	DATE: 01/07/2016
SHEET 15 of 18	

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

b) Hydraulic Testing

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

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

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

c) Performance Test at Shop

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



TITLE:
**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07
VOLUME:
SECTION: IIA
REV. NO. 04 **DATE:** 01/07/2016
SHEET 16 of 18

completion of performance test, all pumps shall be stripped down for inspection of internals.

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

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

11.00.00 DRAWINGS/ DOCUMENTS DISTRIBUTION SCHEDULE

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

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

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

13.00.00 Bidder to submit all drawing/ documents in soft as well as hard copy in the event of order as per schedule indicated in section-IA.

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

Further on receipt of customer's comments on the documents a technical representative from Bidder's works shall come for meeting with Customer to resolve all issues and incorporate all comments in the soft copy and further resubmission of same to Customer. The representative shall be available here till category I approval of all the drawings and documents.

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



TITLE:
**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07

VOLUME:

SECTION: IIA

REV. NO. 04

DATE: 01/07/2016

SHEET 17 of 18

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

- a) Compliance certificate duly signed and stamped (enclosed at Section-IIIB).
- b) GA drawings of pumps and motors with following: (shall be only for reference purpose, same shall not be reviewed/commented by purchaser at this stage and shall be subject to approval only during contract).
 - Civil static & dynamic loads.
 - Foundation details.
 - Minimum Submergence required.
 - Clearances - Side, Back & Bottom
 - Min. Recommended crane capacity
- c) Guarantee Schedule duly signed and stamped (enclosed at Section-IIIA).
- d) Technical deviation schedule (if reqd.) (enclosed at Section-IIIC).
- e) Data for drive Motor (HT/LT- which is not in bidder's scope of supply - as applicable):
Load torque speed curves of the pumps, selected motor rating, rpm, GD² of driven equipment.
- f) Unpriced copy of the price bid shall be furnished along with the technical bid.

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

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



TITLE:
**STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS**

SPECIFICATION NO. PES-179-07

VOLUME:

SECTION: IIA

REV. NO. 04

DATE: 01/07/2016

SHEET 18 of 18

DATA SHEET – C

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

- 1.0** Drawings/documents submission schedule, shall be as per Section-IA.
The successful bidder shall submit at least following drawings/ documents:
- 1.1** Fully dimensioned outline general arrangement drawings of the pump and motor assembly. This drawing should include foundation base plate/sole plate details as applicable, civil foundation, anchor bolt details, loading data (Static and Dynamic), points of connections of external piping, cables and mounting of devices furnished by the supplier and details for Gap between Coupling Shafts, Float & details for axial/radial tolerance allowed etc. which are required for erecting agency during erection of pump.
- 1.2** Cross sectional drawing of the equipment showing the details of assembly of components and their material of construction with standard applicable codes.
- 1.3** Technical datasheet as per Datasheet-B (Section-IIID) including characteristic curves of pumps showing the following:
- a) Flow Vs Head
 - b) Flow Vs Power
 - c) Flow Vs Efficiency
 - d) Flow Vs NPSHR/ minimum submergence
- 1.4** QAP for pump and QAP for motors (if applicable).
- 1.5** GA, Datasheet, Curves etc. for drive motor (as applicable).
- 1.6** Operation and maintenance manual.
- 1.7** Lubrication arrangement drawings for external lubrication (if applicable).
- 1.8** PG test procedure as per clause 3.04.03 (if applicable).
- 1.9** Motor type test document (if applicable).
- 1.10** Test Procedure for Sump Model Study (if applicable).
- 2.0** Within the stipulated time period as per vendor's drawings/ documents schedule as per NIT, the O&M Manual comprising of minimum following shall be submitted:
- a) Drawings of components & details as deemed necessary.
 - b) Instruction manual for erection, operation & maintenance.
 - c) Storage instruction.
- 3.0** Before dispatch of the equipment the bidder shall furnish the following.
- a) Material test certificates.
 - b) Shop test reports & certificates.
 - c) Fulfilment of packing instructions as indicated in Section-IA of this specification.
- 4.0** Distribution of drawings / documents for all projects:

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



**BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN**

Rev-01

QUALITY PLAN FOR MISCELLANEOUS PUMPS			CUSTOMER		PROJECT TITLE							
SHEET 1 OF 6			BIDDER/VENDOR		QUALITY PLAN NUMBER		PE-QP-999-100-N004 For Hor. Pumps)		PE-QP-999-100-N004 (For Ver. Pumps)			
			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	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
SYSTEM		ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL)

SHEET 2 OF 6

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

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



**BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN**

Rev-01

QUALITY PLAN FOR MISCELLANEOUS PUMPS				CUSTOMER			PROJECT TITLE						
				BIDDER/VENDOR			QUALITY PLAN NUMBER						
SHEET 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, CLEANLINES, CLEARANCES, FREENESS, ALIGNMENT	MA	VISUAL EXAM MEASUREMENT	100%	APPROVED DRG & MFG STANDARDS	APPROVED DRG & MFG STANDARDS	I.R. & CHECK LISTS	3/2.			2.1	
BHEL				PARTICULARS			BIDDER / VENDOR						
				NAME									
				SIGNATURE									
				DATE							BIDDER/VENDOR SEAL		

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



**BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN**

Rev-01

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

SHEET 5 OF 6

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

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



**BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN**

Rev-01

QUALITY PLAN FOR MISCELLANEOUS PUMPS	CUSTOMER	PROJECT TITLE
	BIDDER/VENDOR	QUALITY PLAN NUMBER
SHEET 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 VARIIFICATION 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

- AS CAST HEAT MARKS SHALL BE PROVIDED ON CI CASTING LIKE TOP & BOTTOM CASING.
- 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.
- THIS QAP IS ALSO APPLICABLE FOR SPARES.
- NO WELD REPAIRS PERMISSIBLE ON CI CASTING.
- MATERIAL SHALL BE AS PER APPROVED CROSS SECTION DRG./ DATA SHEET.
- 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.
- 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	Prepared By	Reviewed By	Approved By
SIGN.	AJAY JAIN	ASHWANI KHANNA	I. J. SINGH
DATE	23-07-2012	23-07-2012	23-07-2012



TITLE:
**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-405-100-N001**
SECTION: **II**
SUB-SECTION: **IIB**
REV. NO. **01** DATE **07/07/2016**
SHEET **1** OF **1**

SUB-SECTION - IIB

STANDARD TECHNICAL SPECIFICATION (ELECTRICAL)



TITLE :
GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS


SPECIFICATION NO.
PE-SS-999-506-E101
VOLUME NO. : **II-B**
SECTION : **D**
REV NO. : **00** DATE : 28.01.10
SHEET : 1 OF 1

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

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

	TITLE :	SPECIFICATION NO.																														
	GENERAL TECHNICAL REQUIREMENTS	PE-SS-999-506-E101																														
	FOR	VOLUME NO. : II-B																														
	LV MOTORS	SECTION : D																														
		REV NO. : 00 DATE : 28.01.10																														
		SHEET : 1 OF 4																														
<p>1.0 INTENT OF SPECIFICATION</p> <p>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.</p> <p>Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.</p>																																
<p>2.0 CODES AND STANDARDS</p> <p>Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards:</p> <table border="0"> <tr> <td>IS:325</td> <td>Three phase Induction motors</td> </tr> <tr> <td>IS : 900</td> <td>Code of practice for installation and maintenance of induction motors</td> </tr> <tr> <td>IS: 996</td> <td>Single phase small AC and universal motors</td> </tr> <tr> <td>IS: 4722</td> <td>Rotating Electrical machines</td> </tr> <tr> <td>IS: 4691</td> <td>Degree of Protection provided by enclosures for rotating electrical machines</td> </tr> <tr> <td>IS: 4728</td> <td>Terminal marking and direction of rotation rotating electrical machines</td> </tr> <tr> <td>IS: 1231</td> <td>Dimensions of three phase foot mounted induction motors</td> </tr> <tr> <td>IS: 8789</td> <td>Values of performance characteristics for three phase induction motors</td> </tr> <tr> <td>IS: 13555</td> <td>Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment</td> </tr> <tr> <td>IS: 2148</td> <td>Flame proof enclosures for electrical appliance</td> </tr> <tr> <td>IS: 5571</td> <td>Guide for selection of electrical equipment for hazardous areas</td> </tr> <tr> <td>IS: 12824</td> <td>Type of duty and classes of rating assigned</td> </tr> <tr> <td>IS: 12802</td> <td>Temperature rise measurement of rotating electrical machines</td> </tr> <tr> <td>IS: 12065</td> <td>Permissible limits of noise level for rotating electrical machines</td> </tr> <tr> <td>IS: 12075</td> <td>Mechanical vibration of rotating electrical machines</td> </tr> </table> <p>In case of imported motors, motors as per IEC-34 shall also be acceptable.</p>			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 of rotating electrical machines	IS: 12065	Permissible limits of noise level for rotating electrical machines	IS: 12075	Mechanical vibration of rotating electrical machines
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 of rotating electrical machines																															
IS: 12065	Permissible limits of noise level for rotating electrical machines																															
IS: 12075	Mechanical vibration of rotating electrical machines																															
<p>3.0 DESIGN REQUIREMENTS</p>																																
<p>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</p>																																
<p>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.</p>																																
<p>3.3 Starting Requirements</p>																																
<p>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.</p>																																
<p>3.3.2 Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.</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 : 28.01.10
SHEET : 2 OF 4

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

3.3.3 The following frequency of starts shall apply

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

3.4 **Running Requirements**

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

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

3.5 **Stress During bus Transfer**

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

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

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

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


4.0 **CONSTRUCTIONAL FEATURES**

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

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

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

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

	TITLE :	SPECIFICATION NO.
	GENERAL TECHNICAL REQUIREMENTS	PE-SS-999-506-E101
	FOR	VOLUME NO. : II-B
	LV MOTORS	SECTION : D
		REV NO. : 00 DATE : 28.01.10
		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 V 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.	



TITLE :
GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO.
PE-SS-999-506-E101
VOLUME NO. : **II-B**
SECTION : **D**
REV NO. : **00** DATE : 28.01.10
SHEET : 4 OF 4

4.9 General


- 4.9.1 Motors provided for similar drives shall be interchangeable.
- 4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.
- 4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.
- 4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.
- 4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.
- 4.9.6 Name plate with all particulars as per IS: 325 shall be provided
- 4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.


5.0 INSPECTION AND TESTING

- 5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.
- 5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.
- 5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.
- 5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.

6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT

- a) OGA drawing showing the position of terminal boxes, earthing connections etc.
- b) Arrangement drawing of terminal boxes.
- c) Characteristic curves:
(To be given for motor above 55 kW unless otherwise specified in Data Sheet).
- i) Current vs. time at rated voltage and minimum starting voltage.
- ii) Speed vs. time at rated voltage and minimum starting voltage.
- iii) Torque vs. speed at rated voltage and minimum voltage.
For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.
- iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.

		QUALITY PLAN SHEET 1 OF 2		CUSTOMER :			PROJECT		SPECIFICATION :			
				BIDDER/ VENDOR SYSTEM			TITLE		NUMBER :		SPECIFICATION TITLE	
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	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	3	-	-	
2.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	3	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	3	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	3	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	3	2,1	2,1	NOTE -1
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE					BIDDER'S/VENDORS COMPANY SEAL				

		QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :		
				BIDDER/ VENDOR SYSTEM			QUALITY PLAN NUMBER PED-506-00-Q-006/0			SPECIFICATION : TITLE :		
SHEET 2 OF 2		SYSTEM			ITEM AC ELECT. MOTORS BELOW 50KW (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
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	3	1	-	
	NOTES: 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 2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. 3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.											
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			



QUALITY PLAN

SHEET 1 OF 9

CUSTOMER :
 PROJECT TITLE :
 BIDDER/ VENDOR :
 QUALITY PLAN NUMBER PED-506-00-Q-007/2
 SYSTEM :
 ITEM: AC ELECT. MOTORS 50KW & ABOVE (LV & MV)
 SPECIFICATION :
 NUMBER :
 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
1.0	RAW MATERIAL & BROUGHT CONTROL											
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT	3	-	-	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UNEVENNESS ETC.	-DO-	3	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVANT IS/SPEC.	SUPPLIERS TC & LOG	3	-	2	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	-	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVANT IS/	SUPPLIER'S TC	3	-	2	HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUFR'S MA DRG.	NUFR'S DRG.	LOG BOOK	3	-	-	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	-	

BHEL	PARTICULARS	BIDDER/VENDOR
	NAME	
	SIGNATURE	
	DATE	
		BIDDER'S/VENDORS COMPANY SEAL



QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :				
		BIDDER/ VENDOR SYSTEM			QUALITY PLAN NUMBER PED-506-00-Q-007/2			SPECIFICATION : TITLE				
SHEET 2 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 50KW & ABOVE (LV & MV)			SECTION AGENCY		VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE FORMAT NORM	FORMAT OF RECORD	P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2	
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	-	
		4. INTERNAL FLOWS	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. PHYSICAL COND.	MA	-DO-	-DO-	-	NO BREAKAGE ON OTHER PHY. DESIGN	-DO-	3	-	-	
		3. DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	-	
		4. PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	-	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			



QUALITY PLAN

SHEET 3 OF 9

CUSTOMER :	PROJECT TITLE	SPECIFICATION : NUMBER :
BIDDER/ VENDOR :	QUALITY PLAN NUMBER PED-506-00-Q-007/2	SPECIFICATION : TITLE
SYSTEM	ITEM: AC ELECT. MOTORS 50KW & 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
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. 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	
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	

BHEL	PARTICULARS	BIDDER/VENDOR
	NAME	
	SIGNATURE	
	DATE	
		BIDDER'S/VENDORS COMPANY SEAL



QUALITY PLAN

SHEET 4 OF 9

CUSTOMER :

BIDDER/ VENDOR :

SYSTEM :

PROJECT TITLE :

QUALITY PLAN NUMBER PED-506-00-Q-007/2

ITEM: AC ELECT. MOTORS 50KW & ABOVE (LV & MV)

SPECIFICATION : NUMBER :

SPECIFICATION : TITLE :

SECTION : VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE FORMAT 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	-	-	
		1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG.	MANFR'S DRG.	-DO-	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	3	-	-	
1.11	SLIP RING	3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	
		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.	MANUF'S SPEC.	-DO-	3	-	-	
1.12	OIL SEALS & GASKETS	4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	-	
		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

SHEET 5 OF 9

CUSTOMER :	PROJECT TITLE	SPECIFICATION : NUMBER :
BIDDER/ VENDOR :	QUALITY PLAN NUMBER PED-506-00-Q-007/2	SPECIFICATION : TITLE
SYSTEM	ITEM: AC ELECT. MOTORS 50KW & ABOVE (LV & MV)	SECTION VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.0	IN PROCESS											
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVANT SPEC./ ASTM-E165	MANUF'S SPEC./ BHEL SPEC./	-DO-	3	-	1	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANFR'S SPEC/BHEL SPEC./ RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	3	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	3	-	2	
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	3	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	3	-	-	

BHEL	PARTICULARS	BIDDER/VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL



QUALITY PLAN

SHEET 6 OF 9

CUSTOMER :

BIDDER/ VENDOR :

SYSTEM :

PROJECT TITLE

QUALITY PLAN

NUMBER PED-506-00-Q-007/2

ITEM: AC ELECT. MOTORS 50KW & ABOVE (LV & MV)

SPECIFICATION :

NUMBER :

SPECIFICATION :

TITLE

SECTION VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE FORMAT 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	3	-	-	
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	3	-	-	
		3.CORE LOSS & HOTOPT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	3	-	2	
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	3	-	-	
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	3	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	3	-	-	
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	3	-	2	
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	3	2	-	
		6.SURGE WITH STAND AND TAN. DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	3	2	1	
2.6	IMPREGNATION	1.VISCOSCITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	3	-	-	
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	3	-	-	
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	3	-	2	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE									
												BIDDER'S/VENDORS COMPANY SEAL



QUALITY PLAN

SHEET 7 OF 9

CUSTOMER :	PROJECT TITLE	SPECIFICATION : NUMBER :
BIDDER/ VENDOR :	QUALITY PLAN NUMBER PED-506-00-Q-007/2	SPECIFICATION : TITLE
SYSTEM	ITEM: AC ELECT. MOTORS 50KW & ABOVE (LV & MV)	SECTION VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE FORMAT OF RECORD	AGENCY			REMARKS	
								P	W	V		
1	2	3	4	5	6	7	8	9	10			11
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	3	-	2	VERIFICATION FOR MV MOTOR ONLY
		1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-DO-	-DO-	Log Book	3	-	-	
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	3	-	-	
		2.SOUNDNESS	CR	MALLET TEST & MV TEST	-DO-	-DO-	-DO-	Log Book	3	-	-	
		3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	3	-	-	
2.9	COMPLETE ROTOR ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	3	2	1	
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	3	2	-	
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	3	-	-	
		2.WORKMANSHIP	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	3	-	-	
		3.AXIAL PLAY	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	3	-	2	
		4.DIMENSIONS	MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IS	Log Book	3	-	-	
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	MFG SPEC. RELEVANT REL IS	MFG SPEC. EVANT IS	Log Book	3	-	-	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE					BIDDER'S/VENDORS COMPANY SEAL				



QUALITY PLAN

SHEET 8 OF 9

CUSTOMER :

PROJECT TITLE

SPECIFICATION : NUMBER :

BIDDER/ VENDOR SYSTEM

QUALITY PLAN NUMBER PED-506-00-Q-007/2

SPECIFICATION : TITLE

ITEM: AC ELECT. MOTORS 50KW & ABOVE (LV & MV)

SECTION VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE FORMAT 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	3	1	1,2	NOTE - 1
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	3	1,2	1,2	NOTE - 2
		3.VIBRATION	MA	-DO-	100%	IS-12075	IS-12075	-DO-	3	1,2	-	
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	3	2,1	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	3	-	2,1	TC FROM AN INDEPENDENT LABORATORY NOTE-3
		6.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	3	2,1	-	
		7.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	3	-	2,1	NOTE-3
		8.PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	3	2,1	-	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			



QUALITY PLAN

SHEET 9 OF 9

CUSTOMER :	PROJECT TITLE	SPECIFICATION : NUMBER :
BIDDER/ VENDOR :	QUALITY PLAN NUMBER PED-506-00-Q-007/2	SPECIFICATION : TITLE
SYSTEM	ITEM: AC ELECT. MOTORS 50KW & 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

NOTES:

- 1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED.
- 2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON.
- 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED.
- 4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION WITH THE CUSTOMERS, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.

BHEL	PARTICULARS	BIDDER/VENDOR	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL



TITLE:
**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-405-100-N001**
SECTION: **III**
SUB-SECTION:
REV. NO. **01** DATE **07/07/2016**
SHEET **1** OF **1**

SECTION III

DOCUMENTS TO BE SUBMITTED BY BIDDER



TITLE:
**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: PE-TS-405-100-N001	
SECTION: IIIA	
SUB-SECTION:	
REV. NO. 01	DATE 07/07/2016
SHEET 1	OF 1

SECTION IIIA

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



SCHEDULE OF PERFORMANCE GUARANTEES
3X660 MW NORTH KARANPURA STPP, UNIT-1,2&3

SPECN. NO.:	PE-TS-405-100-N001, Rev-01		
VOLUME:	--	SECTION:	IIIA Sheet 1 of 3
REV. NO.	00	DATE:	07/07/2016

Following parameters are guaranteed for following pumps

Sl. No.	Pump Description	Guaranteed Capacity	Guaranteed TDH	Guaranteed Pump Eff.	Guaranteed Motor Eff.	Guaranteed Power consumption at inlet to motor terminals	Pump model	Motor Rating	Pump GD ² Value for HT motor only	Pump RPM	T/S Curve attached for HT motor
		(M3/Hr)	(MWC)	%	%	(KW)		(KW)			
Horizontal pumps (Type-I)											
1	# SERVICE WATER PUMPS	185	78								
2	# HVAC M/U PUMPS	130	52								
3	# ACW MAKE UP PUMPS	125	35								
4	# DM WATER MAKE UP PUMPS	70	65								
5	BOILER FILL PUMPS	140	160								

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

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

PARTICULARS OF BIDDER/ AUTHORISED REPRESENTATIVE

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



SCHEDULE OF PERFORMANCE GUARANTEES
3X660 MW NORTH KARANPURA STPP, UNIT-1,2&3

SPECN. NO.:	PE-TS-410-100-N001, Rev-01		
VOLUME:	--	SECTION:	IIIA Sheet 2 of 3
REV. NO.	00	DATE:	07/07/2016

Following parameters are guaranteed for following pumps

Sl. No.	Pump Description	Guaranteed Capacity	Guaranteed TDH	Guaranteed Pump Eff.	Guaranteed Motor Eff.	Guaranteed Power consumption at inlet to motor terminals	Pump model	Motor Rating	Pump GD ² Value for HT motor only	Pump RPM	T/S Curve attached for HT motor
		(M3/Hr)	(MWC)	%	%	(KW)		(KW)			
Horizontal pumps (Type-II)											
1	# DMCW PUMPS (FOR TG AUX.)	1290	37		93						YES
2	# DMCW PUMPS (FOR SG AUX.)	470	55								
3	# ACW PUMPS	1735	40		93						YES
4	# AHS COOLING PUMPS	820	43								
5	APH/ ESP WASH PUMPS	840	80		93						YES
6	CONDENSATE TRANSFER PUMPS	335	50								

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

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

PARTICULARS OF BIDDER/ AUTHORISED REPRESENTATIVE

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



TITLE:
**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-45-100-N001**

SECTION: **IIIB**

SUB-SECTION:

REV. NO. **01** DATE **07/07/2016**

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

SECTION IIIB

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



TECHNICAL SPECIFICATIONS

SPECN. NO.:

PE-TS-405-100-N001, Rev.01

MISCELLANEOUS PUMPS
COMPLIANCE CERTIFICATE

VOLUME:

--

SECTION:

IIIB

REV. NO.

0

DATE:

07/07/2016

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate and furnish same with the offer.

- a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions/ deviations with regard to same.
- b) QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein.

QP will be subject to BHEL/ CONSULTANT/ CUSTOMER approval in the event of order & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc.
- c) All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/ CONSULTANT/ CUSTOMER approval.
- d) There are no other deviation with respect to specification other than those furnished in the ‘Schedule of Deviations’.
- e) Bidder shall include the cost of Mandatory Spares, unless specified otherwise in Sec-IA of the specification or NIT.

Any mandatory spares stated as not applicable, shall have to be supplied without any cost implication to BHEL in the event they are found to be applicable during detail engineering stage.
- f) The offered materials should be either equivalent or superior to those specified. Also for components where material is not specified it shall be suitable for intended duty. All materials shall be subject to approval in the event of order.
- g) Prices for recommended spares (if any) for 3 years operation shall be furnished separately & not included in the base price.
- h) The commissioning spares (if any) are supplied on ‘As Required Basis’ & prices for same included in the base price (If bidders reply to this is “No commissioning spares are required” and if some spares are actually required during commissioning same shall be supplied by bidder without any cost to BHEL).
- i) All sub vendors shall be as per BHEL/CONSULTANT/CUSTOMER approved list.
- j) Tests for noise, vibration, parallel running etc. for pumps shall be conducted at site by Pump Vendor/BHEL as per cl. no. 3.04.00 of Section-IIA and if the site performance is found not meeting the requirements in any respect as specified, than the equipment shall be rectified or replaced by the vendor, at his own cost.
- k) Any special tools & tackles, if required, shall be in bidder’s scope.
- l) All models offered have been supplied by bidder in the past and are meeting the experience qualifying criteria of BHEL/CONSULTANT/CUSTOMER (viz. offered model is successfully operating in two separate stations for at least one year or as specified in technical PQR). Any deviation to this criteria shall be suitably highlighted in deviation schedule.
- m) All selected motor ratings have minimum margins as per Datasheet A, Section ID.

We the undersigned hereby undertake to meet the compliance requirements as listed above on the conditions as elsewhere specified.

PARTICULARS OF BIDDER/ AUTHORISED REPRESENTATIVE

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



TITLE:
**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-405-100-N001**
SECTION: **IIIC**
SUB-SECTION:
REV. NO. **01** DATE **07/07/2016**
SHEET **1** OF **1**

SECTION IIIC

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



TITLE

*** SCHEDULE OF DEVIATIONS
TECHNICAL**

SPECIFICATION NUMBER

PE-TS-405-100-N001 - Rev-01

SECTION-III C

SHEET OF

Tick the applicable

* Each type of deviation shall be listed on a separate sheet.

We the undersigned hereby certify that the above mentioned are the only deviations.

PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE

PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE				
NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL



TITLE:
**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: PE-TS-405-100-N001	
SECTION: IIID	
SUB-SECTION:	
REV. NO. 01	DATE 07/07/2016
SHEET 1	OF 1

SECTION IIID


DATA SHEET – B FOR PUMPS


ELECTRICAL LOAD DATA FORMAT

CABLE SCHEDULE


MOTOR DATASHEET-C

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

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

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

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

	TITLE	SPECIFICATION NO.	
	<p style="text-align: center;">MOTOR</p> <p style="text-align: center;">DATA SHEET - C</p>	VOLUME	II B
		SECTION	D
		REV NO. 00	DATE 08/09/2010
		SHEET	1 OF 7

LT MOTORS


A. GENERAL

1. Manufacturer & Country of origin.
(Shall be as per approved QA make)
2. Equipment driven by motor
3. Motor type
4. Quantity

B. DESIGN AND PERFORMANCE DATA


1. Frame size
2. Type of duty
3. Type of enclosure /Method of cooling/Degree of protection
4. Applicable standard to which motor generally conforms
5. Efficiency class as per IS 12615
6. (a) Whether motor is flame proof Yes/No
(b) If yes, the gas group to which it conforms as per IS:2148
7. Type of mounting
8. Direction of rotation as viewed from DE END__
9. Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)
10. Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)
11. Maximum continuous load demand of driven equipment in KW
12. Rated Voltage (volts)
13. Permissible variation of :

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE	SPECIFICATION NO.	
	MOTOR DATA SHEET - C	VOLUME	II B
		SECTION	D
		REV NO. 00	DATE 08/09/2010
		SHEET	2 OF 7

- a. Voltage (Volts)
 - b. Frequency (Hz)
 - c. Combined voltage and frequency
14. Rated speed at rated voltage and frequency(RPM)
15. At rated Voltage and frequency:
- a. Full load current
 - b. No load current
16. Power Factor at
- a. 100% load
 - b. NO load
 - c. Starting.
17. Efficiency at rated voltage and frequency,
- a. 100% load
 - b. 75% load
 - c. 50% load
18. Starting current (amps) at
- a. 100 % voltage
 - b. 85% voltage
 - c. 80% voltage
19. Minimum permissible starting Voltage (Volts)
20. Starting time with minimum permissible voltage
- a. Without driven equipment coupled
 - b. With driven equipment coupled

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			


	TITLE	SPECIFICATION NO.		
	MOTOR DATA SHEET - C	VOLUME	II B	
		SECTION	D	
		REV NO. 00	DATE 08/09/2010	
		SHEET	3	OF 7

21. Safe stall time with 100% and 110% of rated voltage
 - a. From hot condition
 - b. From cold condition
22. Torques :
 - a. Starting torque at min. permissible voltage(kg-mtr.)
 - b. Pull up torque at rated voltage.
 - c. Pull out torque
 - d. Min accelerating torque (kg.m) available
 - e. Rated torque (kg.m)
23. Stator winding resistance per phase (ohms at 20 Deg.C.)
24. GD² value of motors
25. No of permissible successive starts when motor is in hot condition
26. Locked Rotor KVA Input
27. Locked Rotor KVA/KW
28. Vibration limit :Velocity (mm/s)
29. Noise level limit (dBA)

C. CONSTRUCTIONAL FEATURES


1. Stator winding insulation
 - a. Class & Type
 - b. Winding Insulation Process
 - c. Tropicalised (Yes/No)

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE	SPECIFICATION NO.	
	MOTOR DATA SHEET - C	VOLUME	II B
		SECTION	D
		REV NO. 00	DATE 08/09/2010
		SHEET	4 OF 7

- d. Temperature rise over specified maximum ambient temperature of 50 deg C
 - e. Method of temperature measurement
 - f. Stator winding connection
2. Main Terminal Box
- a. Type
 - b. Location (viewed from NDE side)
 - c. Entry of cables(bottom/side)
 - d. Recommended cable size (To be matched with cable size envisaged by owner)
 - e. Fault level (MVA), Fault level duration (sec)
 - f. Cable glands & lugs details (shall be suitable for power cable)
3. Type of DE/NDE Bearing
4. Motor Paint shade
5. Weight of
- a. Motor stator (KG)
 - b. Motor Rotor (KG)
 - c. Total weight (KG)
- D. List of accessories.**
- 1. Space Heaters (Applicable for 30 KW & above motor) (Nos./Power in watts/supply voltage)
 - 2. Terminal Box for Space Heater (Yes/No)
 - 3. Speed switch (Yes/No) No of contacts and contact ratings of speed switch

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE	SPECIFICATION NO.	
	MOTOR DATA SHEET - C	VOLUME	II B
		SECTION	D
		REV NO. 00	DATE 08/09/2010
		SHEET	5 OF 7

4. Insulation of bearing (Yes/No)

5. Noise reducer(Yes/No)

6. Grounding pads

i) No and size on motor body

ii) Nos on terminal Box

7. Vibration pads

i) Nos and size

ii) Location

8. Any other fitments

E. List of curves.

1. Torque speed characteristic of the motor

2. Thermal withstand characteristic

3. Starting. current Vs. Time

4. Starting. current Vs speed

5. P.F. and Effi. Vs Load

F. Additional Data to be filled for each rating of DC Motor

1. Rated armature voltage (Volt)

2. Rated field excitation (Amp)

3. Permissible % variation in voltage


4. Minimum Permissible Starting voltage (volt)

5. At rated voltage

i) Full load Armature current.(Amp)


ii) Full load Field current (Amp)

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE	SPECIFICATION NO.	
	MOTOR DATA SHEET - C	VOLUME	II B
		SECTION	D
		REV NO. 00	DATE 08/09/2010
		SHEET	6 OF 7

- iii) No load Armature current (Amp)
6. Full load Field current (Amp)
7. No load Armature current (Amp)
8. Minimum permissible field current(Amp) to avoid overspeeding at
- i) Maximum permissible voltage
- ii) Rated voltage
- iii) Minimum Permissible Voltage
9. Resistance (indicative Values) in ohm
- i) Armature winding (Arm + IP + Series) at 25 deg.C
- ii) Field Winding at 25 deg. C
10. Inductance (indicative values)
- i) Armature winding
- ii) Field winding
11. Value of trimmer resistance (ohm) to be connected in series with the shunt field to obtain rated speed at
- i) 220 V DC
- ii) 250 V DC
- iii) 187 V DC
12. Value of the external resistance (ohm) required to be connected in series with armature during starting only
13. Technical data sheet for external resistance box
14. GA drawing of motor
15. Starting time calculation

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE	SPECIFICATION NO.	
	<p style="text-align: center;">MOTOR</p> <p style="text-align: center;">DATA SHEET - C</p>	VOLUME	II B
		SECTION	D
		REV NO. 00	DATE 08/09/2010
		SHEET	7 OF 7

16. Starter resistance design calculation
17. Electrical connection diagram of motor

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			