

**SEPC POWER PVT. LTD.
MEGHA ENGINEERING & INFRASTRUCTURES LTD.**

**1X525 MW TUTICORIN TPS, STAGE IV (UNIT-1)
THOOTHUKUDI DISTRICT, TAMILNADU**

**TECHNICAL SPECIFICATION
FOR
MISCELLANEOUS PUMPS**

Specification No. : PE-TS-422-100-N001 (REV. 0)



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



TITLE:
**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPEC. NO.: **PE-TS-422-100-N001**

SECTION:

SUB-SECTION:

REV. NO. **0** DATE **06/03/2017**

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THIS TECHNICAL SPECIFICATION CONSISTS OF FOLLOWING SECTIONS:

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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.



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SECTION - I

SPECIFIC TECHNICAL REQUIREMENTS

- SUB-SECTION IA** - Specific Technical Requirements (Mech.)
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TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-422-100-N001**

SECTION: **I**

SUB-SECTION: **IA**

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SUB-SECTION – IA

SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)

	TECHNICAL SPECIFICATIONS		Specification No. : PE-TS-422-100-N001, Rev.0	
	MISCELLANEOUS PUMPS		SECTION: IA	
	SPECIFIC TECHNICAL REQUIREMENTS		REV. NO. 0	DATE: 06/03/2017

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 of Miscellaneous Pumps along with mandatory spares complete with all accessories as per the requirements specified in this specification, installation checks at site, supervision of replacement of gland packing with Mechanical Seal arrangement (as applicable) at site, PG Test at site for Miscellaneous Pumps and any other services, etc. if called for in the succeeding sections of the specification for following project:

1X525 MW TUTICORIN TPS, STAGE IV (UNIT-1)

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.)

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 project 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 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.

3.0 Mechanical run test along with Performance test shall be carried out on all pumps to determine the vibration levels, noise levels etc. at Vendor works. Vibration, Noise and Parallel run test shall also be conducted at site as per approved PG Test Procedure. However, test value at site shall be used for the acceptance of the equipment.
Pump vendor shall bring necessary instruments for conductance of site performance test. If the site performance is found not meeting the requirements in any respect as specified, then the equipment shall be rectified or replaced by the vendor, without any commercial implication to BHEL.

4.0 Additional Dispatch Requirements:

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

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

4.2 Photograph of each box in open & closed condition.

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

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	MISCELLANEOUS PUMPS		SECTION: IA	
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5.0 Drawing/Document Submission Schedule:

	PRIMARY DOCUMENTS			
	BHEL DRG NO	DRG TITLE	Drg Sch for Vendors	REMARKS
MISC. PUMPS (HORIZONTAL)-Type-I	PE-V7-422-100-N001	TDS AND PERFORMACE CURVES-MISC. PUMPS	R-0 within 20 days from LOI/PO & subsequent revisions within 10 days of comments received from BHEL.	Pump Cross Section drawing in case of HT motor driven pump, preliminary(R-0) within 15 days from LOI/PO & final a/w Pump GA within 10 days of receipt of motor GA from BHEL.
	PE-V7-422-100-N002	GENERAL ARRANGEMENT AND CROSS SECTIONAL-PUMPS		
	PE-V7-422-100-N003	TDS AND CURVES OF MOTORS FOR MISC. PUMPS		
	PE-V7-422-100-N004	QP-MISC PUMPS		
	PE-V7-422-100-N005	QP- MOTORS		
	SECONDARY DOCUMENTS			
	PE-V7-422-100-N006	MOTOR TYPE TEST DOC (if applicable)	R-0 within 20 days of Cat-I(or)II approval on motor document.	
	PE-V7-422-100-N007	O& M MANUAL -HORZ. PUMPS	Within 30 days from MDCC	
	PE-V7-422-100-N008	PG TEST PROCEDURE -HOR. PUMPS (IF APPLICABLE)	R-0 within 20 days of Cat-I(or)II approval on pump document.	

	PRIMARY DOCUMENTS			
	BHEL DRG NO	DRG TITLE	Drg Sch for Vendors	REMARKS
MISC. PUMPS (HORIZONTAL)-Type-II	PE-V7-422-100-N011	TDS AND PERFORMACE CURVES-MISC. PUMPS	R-0 within 20 days from LOI/PO & subsequent revisions within 10 days of comments received from BHEL.	Pump Cross Section drawing in case of HT motor driven pump, preliminary(R-0) within 15 days from LOI/PO & final a/w Pump GA within 10 days of receipt of motor GA from BHEL.
	PE-V7-422-100-N012	GENERAL ARRANGEMENT AND CROSS SECTIONAL-PUMPS		
	PE-V7-422-100-N013	TDS AND CURVES OF MOTORS FOR MISC. PUMPS		
	PE-V7-422-100-N014	QP-MISC PUMPS		
	PE-V7-422-100-N015	QP- MOTORS		
	SECONDARY DOCUMENTS			
	PE-V7-422-100-N016	MOTOR TYPE TEST DOC (if applicable)	R-0 within 20 days of Cat-I(or)II approval on motor document.	
	PE-V7-422-100-N017	O& M MANUAL -HORZ. PUMPS	Within 30 days from MDCC	
	PE-V7-422-100-N018	PG TEST PROCEDURE -HOR. PUMPS (IF APPLICABLE)	R-0 within 20 days of Cat-I(or)II approval on pump document.	

	TECHNICAL SPECIFICATIONS	Specification No. : PE-TS-422-100-N001, Rev.0		
	MISCELLANEOUS PUMPS	SECTION:		IA
	SPECIFIC TECHNICAL REQUIREMENTS	REV. NO.	0	DATE: 06/03/2017

Annexure-1

List of Miscellaneous Pumps and drives for :

1X525 MW TUTICORIN TPS, STAGE IV (UNIT-1)

Sl. No.	Pump Description	Total Qty.	Type of Pumps
	Horizontal Pumps (Type-I)		
1	CONDENSATE TRANSFER PUMPS	2 nos.	Horizontal-Type-I
2	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	3 nos.	Horizontal-Type-II
2	DMCW SG AUX. PUMPS	2 nos.	Horizontal-Type-II

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Annexure-2

HT drives for following pumps for 1X525 MW TUTICORIN TPS, STAGE IV (UNIT-1), irrespective of Motor ratings shall be issue free, by BHEL:

Horizontal Pumps (Type-I):
NIL

Horizontal Pumps (Type-II):

1

DMCW TG AUX. PUMPS

2

DMCW SG AUX. PUMPS

	TECHNICAL SPECIFICATIONS		Specification No. : PE-TS-422-100-N001, Rev.0	
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Annexure-3 (Specific requirements for Horizontal pumps as per end customer's specification)

NOT APPLICABLE



TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-422-100-N001**

SECTION: **I**

SUB-SECTION: **IB**

REV. NO. **0** DATE **06/03/2017**

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SUB-SECTION – IB

SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)

	TITLE: ELECTRICAL EQUIPMENT SPECIFICATION FOR MISC. PUMPS 1X525 MW TUTICORIN TPS	SPECIFICATION NO. PE-TS-422-100-N001
		SECTION: I B
		REV NO. : 00 DATE: 07/03/2017
		SHEET: 1 OF 1

SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL

1.0 SCOPE OF ENQUIRY

General technical requirement of LT motors are indicated in specification no. PE-SS-999-506-E101_Rev00. Project specific technical requirement for motors are listed in customer specification for motor & actuators. Stipulations of Customer Specifications shall prevail, in case of conflicts between Customer specification and General technical requirements for LT Motors.

2.0 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 technical, commercial, delivery implications to BHEL/Customer.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipment's.
- d) Erection and commissioning spares.
- e) Erection & Maintenance tools & tackles.
- f) Electrical load requirement
- g) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- h) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer /BHEL approval without any commercial and delivery implications to BHEL.
- i) Various drawings, data sheet as per required format, quality plans, calculations, Type test & Routine test reports & certificates, operation and maintenance manuals, Complete technical literature with catalogues etc shall be furnished as specified at contract stage. All documents shall be subject to customer /BHEL approval without any commercial implications to BHEL.
- j) The sub-vendor list for various electrical items is subject to BHEL/Customer approval without any commercial implications.

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

Refer "Electrical Scope between BHEL and Vendor".

4.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

- 4.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/ quality assurance requirements stipulated. In line with this, the bidder as technical offer shall furnish two signed and stamped copies of the following:
 - a) A copy of this sheet "Electrical Equipment Specification" and sheet "Electrical Scope between BHEL and Vendor" with bidder's signature and company stamp.
 - b) List of Erection and Commissioning spares.
 - c) List of Erection & Maintenance tools & tackles.
 - d) Electrical load requirement.
- 4.2 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 1X525 MW TUTICORIN TPS	SPECIFICATION NO. PE-TS-422-100-N001
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5.0 LIST OF ENCLOSURES

- 5.1 Electrical scope between BHEL & Vendor (Refer: Annexure-1 of Section-IB)
- 5.2 General Technical requirements for LV motors (Refer: Sub Section-II B)
- 5.3 Customer Technical specification for motor (Refer: Annexure-2 of Section-IB)
- 5.4 Electrical Load data format (Refer: Section-III D)
- 5.5 Datasheet-C of Motors & Actuators (to be filled by Vendor) (Refer: Section-III D)
- 5.6 QP for motors (Refer: Sub Section-II B)

Annexure-1 of Section-IB

REV: 0 DATE: 07.03.2017

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

PACKAGE: MISC. PUMP (Supply Package)

PROJECT: **1X525 MW TUTICORIN TPS, STAGE IV (UNIT-1)**

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

NOTES:

1. Make of all electrical equipments/items supplied shall be reputed make & shall be subject to approval of BHEL after award of contract.
 2. All QPs shall be subject to approval of BHEL after award of contract without any commercial implication.
- # Customer: MEIL will provide 415V MCC, below grade Grounding, LT power Cable.

ANNEXURE-2 OF SECTION IB

Customer Technical specification for Motor

ELECTRICAL MOTORS

1.00.00 SCOPE

- 1.01.00 This section covers the general requirements of the drive motors for power station auxiliary equipment.
- 1.02.00 Motors shall be furnished in accordance with both this general specification and the accompanying driven equipment specification.
- 1.03.00 In case of any discrepancy, the driven equipment specification shall govern.

2.00.00 CODES AND STANDARDS

- 2.01.00 All motors shall conform to the latest editions including all applicable amendment of relevant IS, IEC and CBIP Standards/Publications except when otherwise stated herein or in the driven equipment specification.
- 2.02.00 Equipment and material conforming to any other standards, which ensure equal or better quality, may be accepted. In such case, copies of the English version of the standard adopted shall be submitted along with the bid.
- 2.03.00 The electrical installation shall meet the requirements of Indian Electricity Rules as amended upto date and relevant IS Code of Practice. In addition, other rules and regulations applicable to the work shall be followed.
- 2.04.00 Major standards, which shall be followed, are listed below other applicable Indian Standards for any component part even if not covered in the listed standards shall also be followed:

1)	Three phase induction motors	:	IEC:34, IS:325
2)	Crane duty motors	:	IEC:34, IS: 3177
3)	Single phase AC motors	:	IS:996
4)	DC motors/generators	:	IEC, IS:4722
5)	Degree of protection provided by enclosures for rotating electrical machinery	:	IS: 4691
6)	Terminal marking for rotating electrical machinery	:	IS: 4728
7)	Designation of methods of cooling for rotating electrical machinery	:	IS: 6362
8)	Designation for types of construction and mounting arrangements for rotating electrical machinery	:	IS: 2253
9)	Classification of maximum surface temperatures of electrical equipment for use in explosive	:	IS: 8239

	atmospheres		
10)	Flame proof enclosure of electrical apparatus	:	IS: 2148
11)	Rotating Electrical Machines – Specification	:	IS: 4722
12)	Energy efficient Induction motors 3 Ph, squirrel cage	:	IS 12615 - 2011

3.00.00 SERVICE CONDITIONS

- 3.01.00 The motors will be installed in hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash. Canopy shall be provided on all outdoor motors.
- 3.02.00 Unless otherwise noted, electrical equipment/system design shall be based on the service conditions and auxiliary power supply given in the annexure to this specification.
- 3.03.00 For motor installed outdoor and exposed to direct sunrays, the effect of solar heat shall be considered in the determination of the design ambient temperature.

4.00.00 TYPE AND RATING

4.01.00 A.C. Motors

- 4.01.01 Motors shall be general purpose, constant speed, squirrel cage, three/single phase, induction type.
- 4.01.02 All motors shall be rated for continuous duty. They shall also be suitable for long period of inactivity.
- 4.01.03 The motor name-plate rating at 50°C shall have more than 10% margin over the input power requirement of the driven HT equipment at rated duty point unless stated otherwise in driven equipment specification or in general electrical specification.
- 4.01.04 The motor characteristics shall match the requirements of the driven equipment so that adequate starting, accelerating, pull up, break down and full load torques are available for the intended service.
- 4.01.05 All continuous running LT motors shall be energy efficient level IE3 as per IS 12615 - 2011.
- 4.01.06 The motor name plate rating shall have more than 10% margin over the input power requirement of the HT driven equipment and 15% for LT driven equipments at rated duty point. Motors located in hazardous area shall be flameproof type.

4.02.00 D.C. Motors

4.02.01 D.C. motor provided for emergency service shall be shunt/compound wound type.

4.02.02 Motor shall be sized for operation with fixed resistance starter for maximum reliability.

Starter panel complete with all accessories shall be included in the scope of supply. DC motors shall be similar to AC motors with respect to other features like enclosure type, cooling and class of insulation.

5.00.00 PERFORMANCE

5.01.00 Running Requirements

5.01.01 Motor shall run continuously at rated output over the entire range of voltage and frequency variations as given in the annexure

5.01.02 The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals.

Motor shall not stall if the supply voltage drops to 70% of the rated voltage two (2) second duration.

5.01.03 The motor shall be designed to withstand momentary overload of 60% of full load torque for 15 second without any damage.

5.02.00 Starting Requirements

Motor shall be designed for direct online starting at full voltage. Starting current shall not exceed 6 times full load current for all auxiliaries. No further tolerances are applicable on starting current specified above for HT motors. For LT motors, the applicable starting current shall be limited to 7.2 times of full load current including all tolerance.

5.02.01 The motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage.

5.02.02 Motor with rigid coupling shall start with rated load and accelerate to full speed with 80% rated voltage at motor terminal. Minimum starting requirement for fluid coupling shall be 75% rated voltage at motor terminals.

5.02.03 a) Motor shall be capable of three equally spread starts per hour, two starts in quick succession from cold condition and one restart from hot condition.

b) Cranking motor shall be capable of six equally spread starts per hour, three starts in quick succession from cold condition and one restart from hot condition. The coal conveyor and crusher motors shall be suitable for 3 consecutive hot starts with maximum 20 starts per day.

c) Pump motor subject to reverse rotation shall be designed to withstand the stresses encountered when starting with shaft rotating at 125% rated speed in reverse direction.

- 5.02.04 HT pump motors shall be suitable to start with forward rotation.
- 5.02.05 The motors shall be designed to withstand 120% of rated speed for 2 minutes without any mechanical damage
- 5.03.00 **Stress During Bus Transfer**
- 5.03.01 The motor may be subjected to sudden application of 150% rated voltage during bus transfer, due to the phase difference between the incoming voltage and motor residual voltage.
- 5.03.02 The motor shall be designed to withstand any torsional and/or high current stresses, which may result, without experiencing any deterioration in the normal life and performance characteristics.
- 5.04.00 **Locked Rotor Withstand Time**
- 5.04.01 The locked rotor withstand time under hot condition at 110% rated voltage shall be more than motor starting time by at least 2.5 seconds for motors up to 20 seconds starting time and by 5 seconds for motor with more than 20 seconds starting time and upto 45 secs starting time.
- 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.
- 5.04.02 Starting time mentioned above is at minimum permissible voltage of 80% rated voltage. For fluid coupling, said locked rotor withstand time and acceleration time shall correspond to the duration of starting current of motor.
- 5.04.03 Hot thermal withstand curve shall have a margin of at least 10% over the full load current of the motor to permit relay setting utilising motor rated capacity.
- 6.00.00 **SPECIFIC REQUIREMENTS**
- 6.01.00 **Enclosure**
- 6.01.01 All motor enclosures shall conform to the degree of protection IPW-55 unless otherwise specified. Motor for outdoor or semi-outdoor service shall be of weather-proof construction.
- 6.01.02 For hazardous area approved type of increased safety enclosure shall be furnished.
- 6.02.00 **Cooling**
- 6.02.01 The motor shall be self ventilated type, either totally enclosed fan cooled (TEFC) or closed air circuit air- cooled (CACA). For large capacity motors, totally enclosed tube ventilation (TETV) cooling system shall be considered.

- 6.02.02 In case water cooling is required for very large motors, prior approval of the customer is to be obtained before proceeding ahead with design & manufacture.
- 6.03.00 **Winding and Insulation**
- 6.03.01 All insulated winding shall be of copper.
- 6.03.02 All motors shall have class F insulation but limited to class B temperature rise.
- 6.03.03 Windings shall be impregnated to make them non-hygroscopic and oil resistant.
- 6.04.00 **Tropical Protection**
- 6.04.01 All motors shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion.
- 6.04.02 All fittings and hardwares shall be corrosion resistant.
- 6.05.00 **Bearings**
- 6.05.01 Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application.
- 6.05.02 Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred.
- 6.05.03 Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area.
- 6.05.04 Sleeve bearings shall be split type, ring oiled, with permanently aligned, close running shaft sleeves.
- 6.05.05 Grease lubricated bearings shall be prelubricated and shall have provisions for in-service positive lubrication with drains to guard against over lubrication.
- 6.05.06 Oiled bearing shall have an integral self cooled oil reservoir with oil ring inspection ports, oil sight glass with oil level marked for standstill and running conditions and oil fill and drain plugs.
- 6.05.07 Forced lubricated or water cooled bearing shall not be used without prior approval of Owner.
- 6.05.08 Lubricant shall not deteriorate under all service conditions. The lubricant shall be limited to normally available types with IOC equivalent.
- 6.05.09 Bearings shall be insulated as required to prevent shaft current and resultant bearing damage.
- 6.06.00 **Noise & Vibration**
- 6.06.01 The noise level shall be as per statutory acceptance (IS/IEC).

- 6.06.02 The peak amplitude of the vibration shall be within IS/IEC specified limits.
- 6.06.03 The motors rated above 135KW shall be provided with continuous vibration monitoring and protection.
- 6.07.00 **Motor Terminal Box**
- 6.07.01 Motor terminal box shall be detachable type and located in accordance with Indian Standards clearing the motor base- plate/ foundation
- 6.07.02 Terminal box shall be capable of being turned 360 Deg. in steps of 90 Deg. for HT/LT motors unless otherwise approved.
- 6.07.03 The terminal box shall be split type with removable cover with access to connections and shall have the same degree of protection as motor.
- 6.07.04 The terminal box shall have sufficient space inside for termination/connection of XLPE insulated armoured aluminium cables.
- 6.07.05 Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame.
- 6.07.06 The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.
- 6.07.07 The terminal box shall be capable of withstanding maximum system fault current for a duration of 0.25 sec.
- 6.07.08 For 11000V and 3300V motor, the terminal box shall be phase-segregated type. The neutral leads shall be brought out in a separate terminal box (not necessarily phase segregated type) with shorting links for star connection.
- 6.07.09 Motor terminal box shall be furnished with suitable cable lugs and double compression brass glands to match with cable used.
- 6.07.10 The gland plate for single core cable shall be non-magnetic type. In case of motor terminal box being not suitable for specified cable size/number, suitable adopter box/extension box shall be provided.
- 6.08.00 **Grounding**
- 6.08.01 The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GI bolts and washer.
- 6.08.02 The grounding connection shall be suitable for accommodation of ground conductors as follows :
- | | | |
|-------------------------------|---|--------------------|
| Motor above 90 KW | : | 75 x 10 mm GS Flat |
| Motor above 30 KW up to 90 KW | : | 50 x 6 mm GS Flat |
| Motor above 5 KW up to 30 KW | : | 25 x 3 mm GS Flat |
| Motor up to 5 KW | : | 8 SWG GI Wire |

6.08.03 The cable terminal box shall have a separate grounding pad for termination of grounding conductor.

6.09.00 **Rating Plate**

In addition to the minimum information required by IS, the following information shall be shown on motor rating plate :

- a) Temperature rise in Deg.C under rated condition and method of measurement.
- b) Degree of protection.
- c) Bearing identification number and recommended lubricant.
- d) Location of insulated bearings.

6.10.00 **Construction**

a) **Stator Core**

The stator lamination shall be made of high grade silicon/magnetic steel sheet varnished on both sides and pressed to form rigid core.

b) **Rotor**

The rotor construction shall be such that in case of dislodging of the rotor bar from the end ring, it should not come out and hit the stator core/stator winding and damage.

7.00.00 ACCESSORIES

7.01.00 **General**

Accessories shall be furnished, as listed below, or if otherwise required by driven equipment specification or application.

7.02.00 **Space Heater**

7.02.01 Motor of rating 30 KW and above shall be provided with space heaters, suitably located for easy removal or replacement.

7.02.02 The space heater shall be rated 240 V, 1 phase 50 Hz and sized to maintain the motor internal temperature above dew point when the motor is idle.

7.03.00 **Temperature Detectors**

7.03.01 All 11000V and 3300V motors shall be provided with six (6) nos. duplex, or twelve (12) nos. simplex type winding temperature detectors, i.e. two (2) nos. duplex or four (4) nos. Simplex per phase.

- 7.03.02 11000V and 3300V motor bearing shall be provided with duplex type temperature detectors.
- 7.03.03 The temperature detector mentioned above shall be resistance type, 3 wire, platinum wound, 100 Ohms at 0°C.
- 7.03.04 Leads of all simplex type motor winding RTDS and motor bearing RTDS shall be wired up to respective switchgear metering & protection compartment. From which one set of RTDS will be connected to numerical protection relay and another set shall be kept free for DDCMIS connectivity.
- 7.03.05 Five number of Temperature detectors / thermistors shall be provided for L.T. motors above 90 KW (3 numbers winding temperatures & 2 numbers bearing temperatures)
- 7.04.00 **Indicator/Switch**
- 7.04.01 Dial type local indicator with alarm contacts shall be provided for the following :
- 11000 V and 3300V motor bearing temperature.
 - Hot and cold air temperature of the closed air circuit for CACA and CACW motor.
- 7.04.02 Flow switches shall be provided for monitoring cooling water flow of CACW motor and oil flow of forced lubrication bearing, if used.
- 7.04.03 Alarm switch contact rating shall be minimum 0.5 A at 220V D.C. and 2A at 240V A.C.
- 7.05.00 **Current Transformer for Differential Protection**
- 7.05.01 Motor 1000 KW and above shall be provided with three differential current transformers mounted over the neutral leads within the enclosure. Loose 3 numbers CT for mounting on switchgear side shall be in bidder's scope.
- 7.05.02 The arrangement shall be such as to permit easy access for C.T. testing and replacement. Current transformer characteristics shall match Owner's requirements to be intimated later to the successful bidder..
- 7.06.00 **Accessory Terminal Box**
- 7.06.01 All accessory equipment such as space heater, temperature detector, current transformers etc., shall be wired to and terminated in terminal boxes, separate from and independent of motor (power) terminal box.
- 7.06.02 Accessory terminal box shall be complete with double compression brass glands and pressure type terminals to suit cable connections.
- 7.07.00 **Drain Plug**
- Motor shall have drain plugs so located that they will drain the water, resulting from the condensation or other causes from all pockets of the motor casing.

7.08.00 **Lifting Provisions**

Motor weighing 25 Kg. or more shall be provided with eyebolt or other adequate provision of lifting.

Electrical hoists shall be provided for the motors above 1000 kgs for maintenance of the motors

7.09.00 **Dowel Pins**

The motor shall be designed to permit easy access for drilling holes through motor feet or mounting flange for installation of dowel pins after assembling the motor and driven equipment.

7.10.00 **Painting**

Motor including fan shall be painted with corrosion proof paints of colour shade (RAL-7032).

8.00.00 **TESTS**

Routine Tests are to be conducted for all HT motors and for LT motors above 60 KW rating in presence of customer's representative as per IS:325 and required copies of test certificates are to be furnished for approval. In addition, following Type tests shall have to be carried out in presence of Owner representative on all 3.3kV/11kV motors.

- a) Impulse test by 1.2 / 50 micro sec. On sample coil of Stator winding insulation as type test as per IEC-671/IS-14422 : 1995 test voltages as under :

Voltage rating of motor	Impulse Test Voltage
3.3 kV	18 kV peak
11 kV	49 kV peak

- b) Tan delta, charging current and dielectric loss measurements on each phase of motor stator winding as routine test.
- c) Polarization Index Test as per IS:7816 as routine test
- d) Test for suitability of IPW– 55(Weather proof) as per IS 4691 as type test. Type test certificate for first numeral shall be acceptable in lieu to test, provided the test motor is identical to motor being supplied.
- e) Fault Withstand Test for main terminal box as type test. Type test certificate shall be acceptable, if the test has been conducted on exactly identical terminal box.
- f) Test for noise level as routine test.
- g) Test for vibration as routine test.
- h) Tan delta measurement on coils.

- i) Surge withstand test for inter turn insulation.
- j) Test to diagnose rotor bar failure during manufacture.

Tests indicated at (h), (i), (j) shall be carried out during manufacture of the coils and shall be furnished for verification.

9.00.00 DRAWINGS, DATA & MANUALS

Drawings, data & manuals for the motors shall be submitted as indicated below:

9.01.00 Along with the bid

- a) List of the motors
- b) Individual motor data sheet as per format of the proposal data sheets.
- c) Scheme & write up on forced lubrication system, if any
- d) Type test report

9.02.00 After Award of the Contract

- a) Dimensional General Arrangement drawing
- b) Foundation Plan & Loading
- c) Cable end box details
- d) Space requirement for rotor removal
- e) Thermal withstand curves hot & cold
- f) Starting and speed torque characteristics at 80% & 100% voltage
- g) Complete motor data
- h) Erection & Maintenance Manual
- i) Test reports
- j) Data sheets to be enclosed

DESIGN DATA

1.0 AUXILIARY POWER SUPPLY

Supply	Description	Consumer
H.T. Supply	11000 V, 3Ø, 3W, 50 Hz, non-effectively earthed	Motors rated 1500KW & above
	Fault level 44 KA symm.	
	3300 V, 3Ø, 3W, 50 Hz, non-effectively earthed	Motors above 160 KW upto and below 1500KW
	Fault level 40 KA symm.	
L.T. Supply	415V, 3Ø, 3W, 50 Hz effectively earthed	Motors upto and including 160KW
	Fault level 50 KA symm.	
	240V, 1Ø, 2W, 50 Hz effectively earthed	Lighting, space heating, A.C. control & protective devices
D.C. Supply	220V, 2W, unearthed	D.C. alarm, control & protective devices
	Fault level 25* KA.	

* Indicative only, the actual value will be decided by the Bidder, after substantiating the same by calculation.

2.0 RANGE OF VARIATION

A.C. Supply :

Voltage : $\pm 10\%$ Frequency : $\pm 5\%$ Combined Volt : 10% (absolute sum) + frequency

During starting of large motor, the voltage may drop to 80% of the rated voltage for a period of 60 seconds. All electrical equipment while running shall successfully ride over such period without affecting system performance.

D.C. Supply :

Voltage : 187 to 242 Volt

RATING AND REQUIREMENTS AC AND DC MOTORS

		AC Motor	DC Motor
1.0	Application	Continuous duty	
1.1	Type	Squirrel Cage Induction Motor	Shunt/compound
1.2	Voltage Level	11 KV, 3.3 KV and 415 V	220 V
1.3	Voltage variation	±10%	+10%, -15%
1.4	Frequency variation	±5%	--
1.5	Combined Voltage and Frequency variation (absolute)	10%	--
1.6	Rating HT Motors	Above 160KW up to and below 1500 KW suitable for 3.3 KV, 3 Ph, 40 KA, Non-effectively earthed system, Motors 1500 KW and above 11KV, 3 Ph, 3W, 44 KA Non-effectively earthed	
	LT Motors	160 KW & Below suitable for 415 V, 3 Ph, 3 W effectively earthed system of 50 KA fault level	
	DC Motors		220V DC, 2 wire, Unearthed system 25 KA for 1 sec.
1.7	Method of starting	Direct on Line	DC resistance Starter mounted in panel.
1.8	Protection class		
	Indoor	IP-55	
	Outdoor	IPW-55	
1.9	Class of Insulation	F	F
2.0	Temperature Rise Limit	B	B
2.1	Starting Current		

ANNEXURE-B

		AC Motor	DC Motor
	HT Motors	6 Times without further tolerance	
	LT Motors	7.2 times without further tolerance	
	DC Motor		2.5 to 3 (max.) times of FLC without any further tolerance.
2.2	Terminal box		
	Line side	Phase segregated	
	Neutral side	Phase segregated (Optional)	
2.3	Type of Cooling	Totally Enclosed Fan Cooled (TEFC)/Totally Enclosed Tubular Ventilation (TETV)/Closed Air Circuit Air Cooled (CACA)	
2.4	Space Heater	30 KW and above	
2.5	Auxiliary Supply Voltage	415V, 3 Ph/240 V, 1-Ph AC	
2.6	C. T. to be provided in neutral terminal (3 No.) & 3 No. to be supplied loose for mounting in switchgear for HT motors for Differential Protn.		
2.7	Paint shade	RAL-7032, Siemens Gray	

SUB VENDOR LIST
MISC. PUMPS

S. No.	Deptt.	Package	PMD Vendor/ Sub Vendor
1	Electrical	LV MOTORS (NON FLAME PROOF)	ABB
2	Electrical	LV MOTORS (NON FLAME PROOF)	BHARAT BIJLEE LTD.
3	Electrical	LV MOTORS (NON FLAME PROOF)	CROMPTON GREAVES
4	Electrical	LV MOTORS (NON FLAME PROOF)	GE-POWER
5	Electrical	LV MOTORS (NON FLAME PROOF)	KIRLOSKAR ELECTRIC CO LTD.
6	Electrical	LV MOTORS (NON FLAME PROOF)	LAXMI HYDRAULICS PVT. LTD
7	Electrical	LV MOTORS (NON FLAME PROOF)	MARATHON
8	Electrical	LV MOTORS (NON FLAME PROOF)	NGEF
9	Electrical	LV MOTORS (NON FLAME PROOF)	RAJINDRA ELECT INDUSTRIES
10	Electrical	LV MOTORS (NON FLAME PROOF)	SIEMENS
11	Electrical	LV MOTORS (FLAME PROOF)	RAJINDRA ELECT INDUSTRIES
116	Electrical	CABLE GLANDS	ALLIED TRADERS & EXPORTERS
117	Electrical	CABLE GLANDS	ARUP ENGG & FOUNDRY WORKS
118	Electrical	CABLE GLANDS	BALIGA LIGHTING EQPT.PVT.LTD.
119	Electrical	CABLE GLANDS	COMMET BRASS PRODUCTS
120	Electrical	CABLE GLANDS	DOWELLS
121	Electrical	CABLE GLANDS	ELECTROMAC INDUSTRIES
122	Electrical	CABLE GLANDS	INCAB
123	Electrical	CABLE LUGS	DOWELLS
124	Electrical	CABLE LUGS	UNIVERSAL MACHINES LTD.



TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-422-100-N001**

SECTION: **I**

SUB-SECTION: **IC**

REV. NO. **0** DATE **06/03/2017**

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

SUB-SECTION – IC

SPECIFIC TECHNICAL REQUIREMENTS (C&I)

NOT APPLICABLE



TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-422-100-N001**

SECTION: **I**

SUB-SECTION: **ID**

REV. NO. **0** DATE **06/03/2017**

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

SUB-SECTION – ID

DATASHEET-A

	DATA SHEET - A			SPECIFICATION NO.:	PE-TS-422-100-N001, Rev-0
	MISCELLANEOUS PUMPS (HORIZONTAL) - GROUP-I			REV. NO.: 00	DATE : 06/03/2017
	1X525 MW TUTICORIN TPS, STAGE IV (UNIT-1)			VOLUME : ---	SECTION : ID
		HORIZONTAL-TYPE-II		HORIZONTAL-TYPE-I	
Sl. No.	DESCRIPTION	DMCW TG AUX'S PUMPS	DMCW SG AUX'S PUMPS	CONDENSATE TRANSFER PUMPS	BOILER FILL PUMPS
1.0	SERVICE				
1.1	Total no. of pumps for Project	3	2	2	2
1.2	No. of working & standby pumps	(2W+1S) for Station	(1W+1S) for Station	(1W+1S) for Station	(1W+1S) for Station
1.3	Liquid Handled (ref. water analysis enclosed herein)	pH corrected DM Water	pH corrected DM Water	DM Water	DM Water
1.4	Location (Indoor / Outdoor)	Indoor	Indoor	Outdoor	Outdoor
1.5	Duty	Continuous	Continuous	Continuous	Intermittent
1.6	No. of pumps working in parallel	2	-	-	-
1.7	Specific gravity	1	1	1	1
1.8	System design pressure (kg/sqcm), g	10	12	10	25
2.0	DESIGN PARAMETERS				
2.1	Design capacity each, M ³ /hr	1050	690	130	175
2.2	Total dynamic head (MWC)	40	65	50	130
2.3	Suction Pressure(MWC)	30	30	Flooded	Flooded
2.4	Design Temperature (°C)	60	60	60	60
2.5	Maximum permissible speed of pump (RPM)	1500	1500	1500	1500
2.6	Max. limit on shut off head Corresponding to pump TDH (MWC) at 52.5 Hz	Not to exceed 65 MWC	Not to exceed 85 MWC	Not to exceed 90 MWC	Not to exceed 220 MWC
2.7	Operating range	-----30-130% of design duty point flow----- -----			
2.8	Motor rating	Continous Motor rating (at 50 deg C ambient) for all pumps shall be based on following conditions(Whichever is higher including voltage & frquency variation) : (a)The motor rating shall have more than 10% margin over the input power requirement of the HT driven equipment and 15% for LT driven equipments at rated duty point. (b)The motor rating shall have 10% margin over the the maximum power requirement at any condition of the entire characteristic curve of the pump (c) Pump shaft input power required considering overloading of the pump assuming single pump operation in the event of tripping of the other pumps operating in parallel.			
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 / IS 5120			
3.0	CONSTRUCTION FEATURES				
3.1	Pump type	Horizontal centrifugal type Between Bearing Pump	Horizontal centrifugal type Between Bearing Pump	Horizontal centrifugal type	Horizontal centrifugal type
3.2	Impeller type	Closed	Closed	Closed	Closed
3.3	Casing type	Horizontal axial split type	Horizontal axial split type	To be decided by Bidder	To be decided by Bidder
3.4	Coupling type	Flexible type	Flexible type	Flexible type	Flexible type
3.5	Sealing arrangement	Gland packing initially & Mechanical seal finally after commisioning	Gland packing initially & Mechanical seal finally after commisioning	Gland packing initially & Mechanical seal finally after commisioning	Gland packing initially & Mechanical seal finally after commisioning
3.6	Type of Lubrication	Self Liquid/Grease	Self Liquid/Grease	Self Liquid/Grease	Self Liquid/Grease
3.7	Pump characteristics	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable
3.8	Drain Plugs, vent with valve, lifting lugs, priming connection	Required			
4.0	MATERIALS OF CONSTRUCTION				
4.1	Casing	SS ASTM – A351 – CF8M	SS ASTM – A351 – CF8M	SS ASTM – A351 – CF8M	SS ASTM – A351 – CF8M
4.2	Impeller	SS ASTM – A351 – CF8M	SS ASTM – A351 – CF8M	SS ASTM – A351 – CF8M	SS ASTM – A351 – CF8M
4.3	Shaft	SS-316	SS-316	SS 316	SS 316
4.4	Shaft Sleeves	SS-410	SS-410	SS-410	SS-410
4.5	Wearing rings (as applicable)	SS-316/SS CF8M	SS-316/SS CF8M	SS-316/SS CF8M	SS-316/SS CF8M
4.6	Bolts & Nuts	SS-316	SS-316	SS 316	SS 316
4.7	Gland/Seal Cover	SS-316	SS-316	SS-316	SS-316
4.8	Lantern Ring	SS-316	SS-316	SS 316	SS 316
4.9	Mech. seal	Manufacturer standard	Manufacturer standard	Manufacturer standard	Manufacturer standard
4.10	Gland Packing	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)
4.11	Base Plate	MS fabricated IS-2062 (min. thk.-10 mm) Epoxy Coated			
4.12	Stuffing Box	SS ASTM – A351 – CF8M	SS ASTM – A351 – CF8M	SS ASTM – A351 – CF8M	SS ASTM – A351 – CF8M
4.13	Coupling	SS-316	SS-316	SS 316	SS 316
4.14	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	ASTM-A-312 TP 304, ERW	ASTM-A-312 TP 304, ERW
5.0	MANDATORY SPARES	NIL			
6.0	BID EVALUATION RATE				
6.1	Bid evaluation rate	Rs. 2.5 Lacs/KW	Rs. 2.5 Lacs/KW	Rs. 2.5 Lacs/KW	NA
6.2	Maximum permissible efficiency for Bid evaluation				
6.2.1	Pump Efficiency (%)	86	84	72	-
6.2.2	Motor Efficiency (%)	95	95	93.3	-
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.				

DM WATER ANALYSIS - APPLICABLE FOR ALL PROJECTS

ANALYSIS OF DM WATER TO BE USED

FOR

MAKE-UP WATER TO CONDENSER

S.No.	Characteristics		Value
i)	Silica (Max.)	-	0.02 ppm as SiO ₂
ii)	Iron as Fe	-	Nil
iii)	Total hardness	-	Nil
iv)	pH value	-	6.8 to 7.2
v)	Conductivity excluding the effects of free CO ₂	-	Not more than 0.1

NOTE : FOR PASSIVATED DM WATER pH IS 8.5 - 9.5



TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-422-100-N001**

SECTION: **II**

SUB-SECTION: **IIA**

REV. NO. **0** DATE **06/03/2017**

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: BS 5316/1977 Part 2	Acceptance test for centrifugal, mixed flow and axial flow pumps - Class 'B' tests.		
2.01.08	ISO 2548/1973: BS 5316/1976 Part 1	- Do - Class 'C' tests.		
2.01.09	API-610/1989:	Centrifugal pumps for general refinery services.		
2.01.10	HIS	Hydraulic Institute Standards, USA		
2.01.11	PTC 8.2/1965:	Power Test Codes - Centrifugal pumps.		
2.01.12	ASTM-1-165-55	Standard Methods for Liquid Penetration Inspection.		
2.02.00	In case of any contradiction with the above standards and annexure, the stipulations in the annexure shall prevail and shall be binding on the bidder.			
3.00.00	SCOPE OF SUPPLY & SERVICES:			
3.01.00	The miscellaneous pumps and drives scope shall be as specified in Data Sheet A /Section IA.			
3.02.00	The Capacity, Head, Materials of construction and other particulars of pumps are detailed in Data Sheet A of the specification.			
3.03.00	Accessories: All the pumps under this specification shall be complete with following standard/special accessories.			
3.03.01	Standard accessories: a) LT Electric drives/motors (as applicable) with cable gland and lugs at motor end. (The bare HT drive motors and LT motors not in bidder's scope of supply, wherever required supplied as free issue by BHEL refer Cl. 5.08.00). b) Pump motor coupling along with coupling guard. c) Common base plate for pumps and motor. d) Self contained lubrication system along with all internal piping, valves, fittings, specialties etc. as required.			

	TITLE: STANDARD TECHNICAL SPECIFICATION HORIZONTAL PUMPS	SPECIFICATION NO. PES-179-06	
		VOLUME:	
		SECTION: IIA	
		REV. NO. 04	DATE: 01/07/2016
		SHEET 3 of 16	
e) Counter flanges for suction/ discharge nozzles along with fixing nuts, bolts and gaskets. f) Anchor bolts, nuts, seating steel works, shims etc. as necessary for mounting the pump-motor unit on civil foundations. g) Suitable vent (with valves)/ lifting/ handling attachments for the pump/ motor/ accessories. h) Suitable drain connections with isolating valves as applicable. i) Supply of first fill of lubricants with topping requirements for one year of operation after commissioning and handing over of equipment. j) Set of "Special" Tools & Tackles for Pumps and motors, if any. k) Erection and commissioning spares, "on as required" basis. l) Bidder shall provide various drawings, data, calculations, test reports/ certificates, operation and maintenance manuals, As-built drawings, etc. as specified and as necessary. m) Mandatory spares as specified in respective Data Sheet-A of this section. 3.04.00 Services included in Bidder's Scope: 3.04.01 The pumps shall be guaranteed to meet the performance requirements specified vide Data Sheet -A and also for trouble free operation after commissioning. Schedule of performance guarantees (Section-IIIA) duly filled and signed shall be furnished with the bid. 3.04.02 Pumps with Mechanical seal shall be supplied with gland packing arrangement initially to site and gland packing arrangement shall be replaced by vendor with mechanical seal arrangement at site after commissioning of the pumps with gland packing. However Mechanical seal shall be dispatched along with main supply for this purpose. 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. 3.04.03 The pumps erected by the purchaser shall be checked by the bidder for correctness of their installation, alignment, etc. at site prior to their commissioning. 3.04.04 After commissioning of pumps at site, site performance test for Noise, vibration and parallel running of pumps of all pumps for each unit/project 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.			



TITLE:

STANDARD TECHNICAL SPECIFICATION
HORIZONTAL PUMPS

SPECIFICATION NO. PES-179-06

VOLUME:

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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.

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

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

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



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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.

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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.		

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5.14.00	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.		
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. If water handled by pump is dirty/ not suitable for lubrication/ cooling, the bidder shall provide requisite strainer/ filters, tanks, motorized valves, etc. after the tap off for the required service, the arrangement provided shall be subject to Purchaser's approval.		
6.00.00	MANDATORY SPARES:		
6.01.00	Bidder to provide the Mandatory spares listed vide Data Sheet-A. Unit price of mandatory spares shall be furnished in price Schedule.		
6.02.00	Bidder shall include the cost of Mandatory Spares, unless specified otherwise in Sec-IA of the specification or NIT.		



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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, “notwithstanding” anything else stated elsewhere in bidder's offer. The implied/indirect deviations shall not be binding on the purchaser.

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8.00.00	PERFORMANCE REQUIREMENTS		
8.01.00	Performance requirements for the pumps shall be as guided in Data sheet - A enclosed with Section-I.		
8.02.00	Pump(s) shall preferably be designed to have the best efficiency at flow within ± 10% of the specified duty point flow. The pumps shall be suitable for continuous operation at any point within the “Range of Operation” as stipulated in the Data Sheet - A attached with Section-I.		
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.		

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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.		

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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.		



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- 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:



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

b) Hydraulic Testing

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



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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.



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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-III B).
- 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-III A).
- d) Technical deviation schedule (if reqd.) (enclosed at Section-III C).
- 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-III C or NIT. In the absence of duly filled schedules it will be assumed that the bid strictly conforms to the specification.



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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.



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

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



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

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



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

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

NAME SIGN. DATE	Prepared By AJAY JAIN 23-07-2012	Reviewed By ASHWANI KHANNA 23-07-2012	Approved By I. J. SINGH 23-07-2012
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BHARAT HEAVY ELECTRICALS LIMITED
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QUALITY PLAN FOR MISCELLANEOUS PUMPS				CUSTOMER		PROJECT TITLE				
				BIDDER/VENDOR		QUALITY PLAN NUMBER				
SHEET 6 OF 6				SYSTEM		ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL)				

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

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

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

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

P- PERFORM, W- WITNESS, V-VERIFICATION

BHEL	PARTICULARS	BIDDER / VENDOR
	NAME	
	SIGNATURE	
	DATE	

BIDDER/VENDOR SEAL

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

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-422-100-N001**

SECTION: **II**

SUB-SECTION: **IIB**

REV. NO. **0** DATE **06/03/2017**

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 : 29/08/2005
SHEET : 1 OF 1

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

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

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

1.0 INTENT OF SPECIFICATION

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

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

2.0 CODES AND STANDARDS

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

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

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

3.0 DESIGN REQUIREMENTS

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

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

3.3 Starting Requirements

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

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

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

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 29/08/2005
		SHEET : 4 OF 4
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		CUSTOMER :		PROJECT		SPECIFICATION :				
				BIDDER/ VENDOR :		TITLE		NUMBER :				
		SHEET 1 OF 2		SYSTEM		QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01		SPECIFICATION TITLE				
				ITEM AC ELECT. MOTORS BELOW 55KW (LV)		SECTION		VOLUME III				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	NOTE -1 & NOTE-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	2	1		NOTE -1 & NOTE-3
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									

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

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

		QUALITY PLAN		CUSTOMER :		PROJECT			SPECIFICATION :				
				BIDDER/ :		TITLE			NUMBER :				
				VENDOR		QUALITY PLAN			SPECIFICATION :				
SHEET 2 OF 9		SYSTEM		NUMBER PED-506-00-Q-007, REV-03			TITLE			SECTION			
ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		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	
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED	
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2		
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	2		
		4.INTERNAL FLAWS	CR	UT	-DO-	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1		
1.6	SPACE HEATERS, CONNEC- TORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. SPEC.	-DO-	3	-	2	FOR DIA OF 55 MM & ABOVE	
		2. PHYSICAL COND.	MA	-DO-	-DO-	-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	-DO-	3	-	2		
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	2		
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	2		
BHEL			PARTICULARS		BIDDER/VENDOR								
			NAME										
			SIGNATURE										
			DATE					BIDDER'S/VENDORS COMPANY SEAL					

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

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

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



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

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

		QUALITY PLAN		CUSTOMER :		PROJECT TITLE			SPECIFICATION : NUMBER :			
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
		SHEET 8 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC.	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1*	1	* NOTE - 1
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1\$	1	\$ NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	2	1\$	1	\$ NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1\$	1	\$ NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1\$	1	\$ NOTE - 2
		8. NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1\$	1	\$ NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1\$	1	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY \$ NOTE - 2
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
									BIDDER'S/VENDORS COMPANY SEAL			

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

SUB VENDOR LIST
MISC. PUMPS

S. No.	Deptt.	Package	PMD Vendor/ Sub Vendor
1	Electrical	LV MOTORS (NON FLAME PROOF)	ABB
2	Electrical	LV MOTORS (NON FLAME PROOF)	BHARAT BIJLEE LTD.
3	Electrical	LV MOTORS (NON FLAME PROOF)	CROMPTON GREAVES
4	Electrical	LV MOTORS (NON FLAME PROOF)	GE-POWER
5	Electrical	LV MOTORS (NON FLAME PROOF)	KIRLOSKAR ELECTRIC CO LTD.
6	Electrical	LV MOTORS (NON FLAME PROOF)	LAXMI HYDRAULICS PVT. LTD
7	Electrical	LV MOTORS (NON FLAME PROOF)	MARATHON
8	Electrical	LV MOTORS (NON FLAME PROOF)	NGEF
9	Electrical	LV MOTORS (NON FLAME PROOF)	RAJINDRA ELECT INDUSTRIES
10	Electrical	LV MOTORS (NON FLAME PROOF)	SIEMENS
11	Electrical	LV MOTORS (FLAME PROOF)	RAJINDRA ELECT INDUSTRIES
116	Electrical	CABLE GLANDS	ALLIED TRADERS & EXPORTERS
117	Electrical	CABLE GLANDS	ARUP ENGG & FOUNDRY WORKS
118	Electrical	CABLE GLANDS	BALIGA LIGHTING EQPT.PVT.LTD.
119	Electrical	CABLE GLANDS	COMMET BRASS PRODUCTS
120	Electrical	CABLE GLANDS	DOWELLS
121	Electrical	CABLE GLANDS	ELECTROMAC INDUSTRIES
122	Electrical	CABLE GLANDS	INCAB
123	Electrical	CABLE LUGS	DOWELLS
124	Electrical	CABLE LUGS	UNIVERSAL MACHINES LTD.



TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPEC. NO.: **PE-TS-422-100-N001**

SECTION: **III**

SUB-SECTION:

REV. NO. **0** DATE 06/03/2017

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

SECTION III

DOCUMENTS TO BE SUBMITTED BY BIDDER



TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPEC. NO.: **PE-TS-422-100-N001**

SECTION: **IIIA**

SUB-SECTION:

REV. NO. **0** DATE 06/03/2017

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

SECTION IIIA

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

**SCHEDULE OF PERFORMANCE GUARANTEES****1X525 MW TUTICORIN TPS, STAGE IV (UNIT-1)**

SPECN. NO.:

PE-TS-422-100-N001, Rev-0

VOLUME:

--

SECTION:

IIIA

Sheet 1 of 2

REV. NO.

00

DATE:

06/03/2017

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	#CONDENSATE TRANSFER PUMPS	130	50								
2	BOILER FILL PUMPS	175	130								

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
1X525 MW TUTICORIN TPS, STAGE IV (UNIT-1)

SPECN. NO.:

PE-TS-422-100-N001, Rev-0

VOLUME:

--

SECTION:

IIIA

Sheet 2 of 2

REV. NO.

00

DATE:

06/03/2017

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 TG AUX. PUMPS	1050	40		95						YES
2	# DMCW SG AUX. PUMPS	690	65		95						YES

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

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

PARTICULARS OF BIDDER/ AUTHORISED REPRESENTATIVE

NAME

DESIGNATION

SIGNATURE

DATE

COMPANY SEAL



TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPEC. NO.: **PE-TS-422-100-N001**

SECTION: **IIIB**

SUB-SECTION:

REV. NO. **0** DATE 06/03/2017

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

SECTION IIIB

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



TECHNICAL SPECIFICATIONS

SPECN. NO.:

PE-TS-422-100-N001, Rev.0

MISCELLANEOUS PUMPS
COMPLIANCE CERTIFICATE

VOLUME:

--

SECTION:

IIIB

REV. NO.

0

DATE:

06/03/2017

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**

SPEC. NO.: **PE-TS-422-100-N001**

SECTION: **IIIC**

SUB-SECTION:

REV. NO. **0** DATE 06/03/2017

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

SECTION IIIC

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

	TITLE * SCHEDULE OF DEVIATIONS () From Conditions of Contract (Volume - I) () From General Technical Conditions (Volume - II A) () From Technical Specifications (Volume - II B)				SPECIFICATION NUMBER PE-TS-422-100-N001	
					VOLUME III PART - A	
					SHEET OF	
We the undersigned hereby certify that the above mentioned are the only deviations.						
PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE						
NAME	DESIGNATION	SIGNATURE	DATE			
					COMPANY SEAL	



TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPEC. NO.: **PE-TS-422-100-N001**

SECTION: **IIID**

SUB-SECTION:

REV. NO. **0** DATE 06/03/2017

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

		PROJECT: MISCELLANEOUS PUMPS DATASHEET - B		VENDOR DOC. NO.		REV NO.	
				BHEL DOC. NO.		REV NO.	
SL.	DESCRIPTION	UOM	PUMP DATA	PUMP DATA	PUMP DATA		
3.8	Specific speed $N = \text{RPM} \times (\text{Flow in USGPM})^{1/2} / (\text{Head in Ft.})^{3/4}$						
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					
8.3	Size of base plate (length x width)	mm					

[illegible]

NOTES:

1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)

2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (dc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V

: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTOR CONTROLLED)



ANNEXURE III

[illegible]

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

- 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 MOTOR DATA SHEET - C	SPECIFICATION NO.	
		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. GD^2 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 MOTOR DATA SHEET - C	SPECIFICATION NO.	
		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 MOTOR DATA SHEET - C	SPECIFICATION NO.	
		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 MOTOR DATA SHEET - C	SPECIFICATION NO.	
		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 MOTOR DATA SHEET - C	SPECIFICATION NO.
		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			