

NABINAGAR POWER GENERATING COMPANY PVT. LTD. (NPGCPL)

BHARATIYA RAIL BIJLEE COMPANY LTD. (BRBCL)

**NPGCPL 3X660 MW NABINAGAR STPP
FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE**

**BRBCL 4X250 MW NABINAGAR TPP
FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE**

**TECHNICAL SPECIFICATION
FOR
MISCELLANEOUS PUMPS (HORIZONTAL)**

Specification No. : PE-TS-457/463-100-N001 (REV. 00)



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

	TITLE: TECHNICAL SPECIFICATION MISCELLANEOUS PUMPS SPECIFIC TECHNICAL REQUIREMENTS	SPEC. NO.: PE-TS-457/463-100-N001		
		SECTION:		
		SUB-SECTION:		
		REV. NO. 00	DATE	14.12.2021
		SHEET 1	OF 1	

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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.

3) In case there is conflict in different clauses of specification, most stringent clause (as decided by BHEL / end customer) shall be followed, if no specific deviation is taken by bidder and accepted by BHEL during tender stage in that regard.

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SECTION - I

SPECIFIC TECHNICAL REQUIREMENTS

SUB-SECTION IA - Specific Technical Requirements (Mech.)

SUB-SECTION IB - Specific Technical Requirements (Electrical)


~~**SUB-SECTION IC** - Specific Technical Requirements (C & I)~~

SUB-SECTION ID – Datasheet-A

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SUB-SECTION – IA**SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)**

	TECHNICAL SPECIFICATIONS		Specification No. : PE-TS-457/463-100-N001, Rev.0	
	MISCELLANEOUS PUMPS		SECTION:	IA
	SPECIFIC TECHNICAL REQUIREMENTS		REV. NO.	DATE:
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1.0 SCOPE				
1.1 This enquiry covers the design, manufacture, assembly, inspection and testing at manufacturer's and/or his sub-contractors works, painting, proper packing to avoid damage of items during transportation & storage at site of Miscellaneous Pumps (along with Motors & mandatory spares as applicable), transportation to site, complete with all other accessories as per the requirements specified in this specification, site services including installation checks of pump motor set & supervision of replacement of gland packing with Mechanical Seal arrangement (if applicable) at site for Miscellaneous Pumps, PG Test at site and any other services, etc. if called for in the succeeding sections of the specification for the following projects:				
(1) NPGCPL 3X660 MW NABINAGAR -FGD PROJECT				
(2) BRBCL 4X250 MW NABINAGAR TPP -FGD PROJECT				
1.2 The miscellaneous pumps covered under this specification shall be grouped (Type) as under:				
i. Horizontal Pumps				
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(s)/Group(s) in his scope. Part supplies offered for the Project(s)/Group(s) shall disqualify the bidder's offer for that Project(s)/Group(s).				
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.				
1.4 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.				
1.5 For detailed scope of supply & services refer Standard technical Specification for Horizontal Centrifugal pumps specified under Section-II of this specification.				
1.6 Electrical scope between BHEL and Vendor for Miscellaneous pumps and drives of this specification shall be as per Section-IB of this specification.				
LT drives shall be energy efficient as per subsequent clauses mentioned elsewhere in the specification. However wherever IE2 compliant motors are applicable same shall be provided with Premium Efficiency class-IE3 compliance (refer Specific Technical requirements-Electrical Section).				
1.7 <u>DELIVERY & DOCUMENT SUBMISSION SCHEDULE:</u>				
Delivery & Document submission schedule of miscellaneous pumps shall be as per NIT requirement.				
1.8 Evaluation and LD criterion w.r.t. Auxiliary Power is defined at clause 4.0 of Section IIA of this specification. In case bidder quotes Aux. power less than Benchmark Auxiliary Power, then quoted Aux. power shall be replaced with Benchmark Auxiliary Power for both evaluation as well as LD purposes.				
2.0 <u>Horizontal Pumps:</u>				
2.1 Additional Specific requirements for Horizontal pumps shall be as per end customer's specification attached in this section-IA.				
2.2 In case, shaft sleeve is threaded a water slinger shall be provided on the Pump Shaft to avoid ingress of leaked water (if any due to failure of sealing arrangement for shaft sleeve) to Bearing.				
2.3 In case of axial split casing Multistage pumps, minimum factor of safety of '2' times shall be considered for bearing capacity selection and pump design.				
2.4 Deleted				

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TECHNICAL SPECIFICATIONS
MISCELLANEOUS PUMPS
SPECIFIC TECHNICAL REQUIREMENTS

Specification No. : PE-TS-457/463-100-N001, Rev.0

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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 operation run test without hunting and abnormal noise and with flow sharing within 10% of each other at the rated duty point shall also be conducted by vendor at site for All Pumps and as per approved PG Test Procedure, inline with CI no. 3.04 of Section-IIA of this specification.** 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 Deleted

5.0 Additional Dispatch Requirements:

MDCC after final inspection shall be provided to vendor subject to submission of following documents along with meeting the other requirements stated in NIT :-

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

5.2 Photograph of each box in open & closed condition.


5.3 Bidder to include handling instructions on Packed Box of each item & in Engineering drg/doc/O&M Manual 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 during contract stage by BHEL/Customer

6.0 Drawing/Document Submission Schedule:

PACKAGE	BHEL DRG NO	DRG TITLE	Drg Sch for Vendors	Remarks
MISC.PUMPS (HORIZONTAL)	PE-V7-457/463-100-N001	TDS AND PERFORMANCE CURVES- MISC. PUMPS (HORIZONTAL)	As per NIT	
	PE-V7-457/463-100-N002	GENERAL ARRANGEMENT AND CROSS SECTIONAL-PUMPS (HORIZONTAL)		
	PE-V7-457/463-100-N003	TDS AND CURVES OF MOTORS FOR MISC. PUMPS (HORIZONTAL)		
	PE-V7-457/463-100-N004	QP-MISC PUMPS (HORIZONTAL)		
	PE-V7-457/463-100-N005	QP- MOTORS (HORIZONTAL)		
	PE-V7-457/463-100-N006	MOTOR TYPE TEST DOC (if applicable) (HORIZONTAL)	As per NIT	
	PE-V7-457/463-100-N007	O& M MANUAL -HORZ. PUMPS	As per NIT	
	PE-V7-457/463-100-N008	PG TEST PROCEDURE -HOR. PUMPS (If Applicable)	R-0 within 20 days of Cat-I approval on all Pump & Motor documents (TDS, GA drg & QPs).	

Note: Drawings submitted shall be complete in all respects with revised drawing submitted incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays to bidder's account. For any clarification / discussion required to complete the drawings, the bidder shall himself depute his personnel to BHEL for across the table discussions/ finalizations / submissions of drawings

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7.0 Following to be complied by the bidder:

- Supplier to submit detailed 'Bill of Material' (BoM) at the time of drawing/document submission after placement of PO. Each item of the BoM to be uniquely identified with item code no. or item serial no.
- Supplier to ensure that all items which will find separate mention in the packing list are covered in this detailed BoM.
- Supplier to give following undertaking in the BoM

"The BoM provided herewith completes the scope (in content and intent) of material supply under PO no.-----, dated -----.

Any additional material which may become necessary for the intended application of the supplied items(s)/package will be supplied free of cost in most reasonable time."

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Annexure-1

List of Miscellaneous Pumps and drives for :


NPGCPL 3X660 MW NABINAGAR -FGD PROJECT

Sl. No.	Pump Description	Total Qty.	Type of Pumps
A.	Horizontal Pumps		
1	ECW(DMCW) PUMPS	4 nos.	Horizontal
2	ACW PUMPS	5 nos.	Horizontal

BRBCL 4X250 MW NABINAGAR -FGD PROJECT

Sl. No.	Pump Description	Total Qty.	Type of Pumps
A.	Horizontal Pumps		
1	ECW(DMCW) PUMPS	5 nos.	Horizontal
2	ACW PUMPS	6 nos.	Horizontal

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Annexure-2				
<p>Following HT drives for NPGCPL 3X660 MW NABINAGAR -FGD PROJECT, irrespective of Motor ratings shall be issue free, by BHEL:</p> <p>NIL</p>				
<p>Following HT drives for BRBCL 4X250 MW NABINAGAR -FGD PROJECT, irrespective of Motor ratings shall be issue free, by BHEL:</p> <p>NIL</p>				

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Annexure-I to ECW system Specification					
GENERAL SPECIFICATION FOR HORIZONTAL PUMPS					
(1)		SCOPE			
		This specification covers the design, material, construction features, manufacture, inspection, testing the performance at the Vendor's/Sub-Vendor's Works and delivery to site of Horizontal Centrifugal Pumps.			
(2)		CODES AND STANDARDS			
		The design, material, construction, manufacture inspection and performance testing of Horizontal Centrifugal Pumps shall comply with all currently applicable statutes, regulations and safety codes in the locality where the Equipment will be installed. Nothing in these specifications shall be construed to relieve the Vendor of this responsibility. The Equipment supplied shall comply with the latest applicable Indian Standards listed below. Other National Standards are acceptable, if they are established to be equal or superior to the Indian Standards.			
(3)		LIST OF APPLICABLE STANDARDS			
		IS : 1520 : Horizontal Centrifugal Pumps for clear cold fresh water			
		IS : 5120 : Technical requirements of rotodynamic special purpose pumps			
		API : 610 : Centrifugal pumps for general refinery service.			
		IS : 5639 : Pumps Handling Chemicals & corrosion liquids			
		IS : 5659 : Pumps for process water			
		HIS : Hydraulic Institute Standards, USA			
		ASTM-1-165-65: Standards Methods for Liquid Penetration Inspection.			
		In case of any contradiction with aforesaid standards and the stipulations as per the technical specifications as specified hereinafter the stipulations of the technical specifications shall prevail.			
(4)		DESIGN REQUIREMENTS			
		(a) The Pump shall be capable of developing the required total head at rated capacity for continuous operation. Also the pumps shall be capable of being operated to give satisfactory performance at any point on the HQ characteristics curve. The operating range of the pump shall be 40% to 120% of the duty point unless otherwise mentioned elsewhere. The maximum efficiency			
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	<p>of pump shall preferably be within $\pm 10\%$ of the rated design flow as indicated in data sheets.</p> <p>(b) The total head capacity curve shall be continuously rising from the operating point towards shut – off without any zone of instability with the highest head at shut-off condition. Shut-off head shall be more than the rated design head by 15 % or more for radial flow pump and 25 % more than the design head for mixed flow/turbine type pumps.</p> <p>(c) Pumps of a particular category shall be identical and shall be suitable for parallel operation with equal load division. The head Vs capacity and BHP Vs capacity characteristics should match to ensure even load sharing and trouble free operation throughout the range. Components of identical pumps shall be interchangeable.</p> <p>(d) Pumps shall run smoothly without undue noise and vibration. Peak to peak vibration limits shall be restricted to the following values during operation:</p> <table data-bbox="446 724 1404 892"> <thead> <tr> <th><u>Speed</u></th><th><u>Antifriction Bearing</u></th><th><u>Sleeve Bearing</u></th></tr> </thead> <tbody> <tr> <td>1500 rpm and below</td><td>75.0 micron</td><td>75.0 micron</td></tr> <tr> <td>3000 rpm</td><td>50.0 micron</td><td>65.0 micron</td></tr> </tbody> </table> <p>The noise level shall not exceed 85 dBA overall sound pressure level reference 0.0002 microbar (the standard pressure reference for air sound measurement) at a distance of 1 M from the equipment surface.</p> <p>(e) The pumps shall be capable of starting with discharge valve fully open and close condition. Motors shall be selected to suit to the above requirements.</p> <p>(f) Pumps shall be so designed that pump impellers and other accessories of the pumps are not damaged due to flow reversal.</p> <p>(g) The Contractor under this specification shall assume full responsibility in the operation of pump and motor as a unit.</p> <p>(5) DESIGN CONSTRUCTION</p> <p>(a) Design and construction of various components of the pumps shall conform to the following general specifications. For material of construction of the components, data sheets shall be referred to.</p> <p>(b) Pump Casing</p> <p>Pump casing shall have axially or radially split type construction as specified. The casing shall be designed to withstand the maximum shut-off pressure developed by the pump at the pumping temperature.</p> <p>Pump casing shall be provided with a vent connection and piping with fittings & valves. Casing drain as required shall be provided complete with drain valves,</p>	<u>Speed</u>	<u>Antifriction Bearing</u>	<u>Sleeve Bearing</u>	1500 rpm and below	75.0 micron	75.0 micron	3000 rpm	50.0 micron	65.0 micron	
<u>Speed</u>	<u>Antifriction Bearing</u>	<u>Sleeve Bearing</u>									
1500 rpm and below	75.0 micron	75.0 micron									
3000 rpm	50.0 micron	65.0 micron									
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-0011-109(1A)-2	SUB SECTION: I-M5 EQUIPMENT COOLING WATER SYSTEM PAGE 12 OF 16									

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	<p>pipings and plugs. It shall be provided with a connection for suction and discharge pressure gauge as standard feature. It shall be structurally sound to provide housing for the pump assembly and shall be designed hydraulically to minimum radial load at part load operation.</p> <p>(c) Impeller</p> <p>Impeller shall be closed, semi-closed or open type as specified elsewhere and designed in conformance with the detailed analysis of the liquid being handled.</p> <p>The impeller shall be secured to the shaft, and shall be retained against circumferential movement by keying, pinning or lock rings. On pumps with overhung shaft, impellers shall be secured to the shaft by a lockout or cap screw which tightness in the direction of normal rotation.</p> <p>(d) Impeller/Casing Wearing Rings</p> <p>Replaceable type wearing rings shall be provided at suitable locations of pumps as per manufacturer's standard practice. Suitable method of locking the wearing ring shall be used.</p> <p>(e) Shaft</p> <p>The critical speed shall be well away from the operating speed and in no case less than 130% of the rated speed.</p> <p>The shaft shall be ground and polished to final dimensions and shall be adequately sized to withstand all stresses from rotor weight, hydraulic loads, vibration and torques coming in during operation.</p> <p>(f) Shaft Sleeves</p> <p>Renewable type fine finished shaft sleeves shall be provided at the stuffing boxes/mechanical seals. Length of the shaft sleeves must extend beyond the outer faces of gland packing of seal end plates so as to distinguish between the leakage between shaft and shaft sleeve and that past the seals/gland.</p> <p>Shaft sleeves shall be fastened to the shaft to prevent any leakage or loosening. Shaft and shaft sleeve assembly should ensure concentric rotation.</p> <p>(g) Bearings</p> <p>Heavy duty bearings, adequately designed for the type of service specified in the enclosed pump data sheet and for long, trouble free operation shall be furnished.</p> <p>The bearings offered shall be capable of taking both the radial and axial thrust coming into play during operation. In case, sleeve bearings are offered additional thrust bearings shall be provided. Antifriction bearings of standard</p>			
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-0011-109(1A)-2	SUB SECTION: I-M5 EQUIPMENT COOLING WATER SYSTEM	PAGE 13 OF 16

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	<p>type, if provided, shall be selected for a minimum life 20,000 hrs. of continuous operation at maximum axial and radial loads and rated speed.</p> <p>Proper lubricating arrangement for the bearings shall be provided. The design shall be such that the bearing lubricating element does not contaminate the liquid pumped. Where there is a possibility of liquid entering the bearings suitable arrangement in the form of deflectors or any other suitable arrangement must be provided ahead of bearings assembly.</p> <p>Bearings shall be easily accessible without disturbing the pump assembly. A drain plug shall be provided at the bottom of each bearings housing.</p> <p>(h) Stuffing Boxes</p> <p>Stuffing boxes of packed ring construction type shall be provided wherever specified. Packed ring stuffing boxes shall be properly lubricated and sealed as per service requirements and manufacturer's standards. If external gland sealing is required, it shall be done from the pump discharge. The Bidder shall provide the necessary piping valves, fittings etc. for the gland sealing connection.</p> <p>(i) Mechanical Seals</p> <p>Wherever specified in pump data sheet, mechanical seals shall be provided. Unless otherwise recommended by the tenderer, mechanical seals shall be of single type with either sliding gasket or bellows between the axially moving face and shaft sleeves or any other suitable type. The sealing faces should be highly lapped surfaces of materials known for their low frictional coefficient and resistance to corrosion against the liquid being pumped.</p> <p>(j) The pump supplier shall coordinate with the seal maker in establishing the seal chamber of circulation rate for maintaining a stable film at the seal face. The seal piping system shall form an integral part of the pump assembly. For the seals under vacuum service, the seal design must ensure sealing against atmospheric pressure even when the pumps are not operating. Necessary provision for seal water supply along with complete piping fittings and valves as required shall form integral part of pump supply.</p> <p>(k) Pump Shaft Motor Shaft Coupling</p> <p>The pump and motor shafts shall be connected with an adequately sized flexible coupling of proven design with a spacer to facilitate dismantling of the pump without disturbing the motor. Necessary coupling guards shall also be provided.</p> <p>(l) Base Plate</p> <p>A common base plate mounting both for the pump and motor shall be furnished. The base plate shall be fabricated steel and of rigid construction, suitably ribbed and reinforced. Base plate and pump supports shall be so</p>			
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOC. NO.:CS-0011-109(1A)-2	SUB SECTION: I-M5 EQUIPMENT COOLING WATER SYSTEM	PAGE 14 OF 16

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	<p>constructed and the piping unit so mounted as to minimize misalignment caused by mechanical forces such as normal piping strain, internal differential thermal expansion and hydraulic piping thrust. Suitable drain troughs and drip lip shall be provided.</p> <p>(m) Assembly and Dismantling</p> <p>Assembly and dismantling of each pump with drive motor shall be possible without disturbing the grouting base plate or alignment.</p> <p>(n) Drive Motor (Prime Mover)</p> <p>Continuous Motor rating (at 50 °C ambient) shall be at least ten percent (10%) above the maximum load demand of the pump in the entire operating range to take care of the system frequency variation and in no case less than the maximum power requirement at any condition of the entire characteristic curve of the pump. The KW rating of the drive unit shall be based on continuously driving the connected equipment for the conditions specified. However, in cases where parallel operation of the pumps are specified, the actual motor rating is to be selected by the Bidder considering overloading of the pumps in the event of tripping of operating pump(s).</p>			
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CLAUSE NO.

QUALITY ASSURANCE




EQUIPMENT COOLING WATER SYSTEM													
	TEST / CHECKS 												

NOTES

- One per heat / HT batch
- DP Test shall be conducted for 10% of the lot of HT plates. However, in case of any defect, entire lot shall be tested and only defect free plates shall be accepted.
- 100% DP Test shall be conducted on butt welds and 10% DPT on fillet weld after final run.
- 100% DPT shall be carried out on machined surfaces.
- UT shall be done on plates with thickness 25 mm or above.
- UT shall be done on shaft / tie rod with diameter above 40 mm.
- After pressing each HT plate shall be subjected to either of the following tests, as per Manufacturer Practice
a) Light Box Test b) Vacuum Test c) Air Chamber Test
- All pressure retaining parts shall be hydrostatically tested at 200% of pump rated head or 150% of shut – off head, whichever is higher, for at least 30 minutes. No leakage is allowed.
- Static and Dynamic Balancing shall be carried out on complete rotor assembly.
- All pumps shall be tested at rated speed, for head, flow capacity, efficiency and power consumption for the entire operating range i.e. from shut off head to maximum flow. A minimum of 7 readings shall be taken to plot the curve, with one reading at design flow. Testing standard shall be HIS (Hydraulic Institute Standard) of USA.
Performance test shall be carried out with contract motor, wherever Liquidated Damages are to be ascertained based on performance test at shop.
- For Pipes, Valves and RE Joints refer LP Piping System requirements.

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SUB-SECTION – IB

SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)

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FILE :
ELECTRICAL EQUIPMENT SPECIFICATION
MISC PUMPS
4 X 250MW NABINAGAR -FGD
3 X 660MW NABINAGAR-I FGD

SPECIFICATION NO.

VOLUME NO. : **II-B**SECTION : **I**REV NO. : **00** DATE : **04.10.2021**

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TECHNICAL SPECIFICATION
FOR
MISC PUMPS
(ELECTRICAL PORTION)



FILE :	SPECIFICATION NO.
ELECTRICAL EQUIPMENT SPECIFICATION	
MISC PUMPS	VOLUME NO. : II-B
4 X 250MW NABINAGAR -FGD	SECTION : I
3 X 660MW NABINAGAR-I FGD	REV NO. : 00 DATE : 04.10.2021
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1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Electrical load requirement for MISC PUMPS.
- e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL
- g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
- h) Motor shall meet minimum requirement of motor specification.
- i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- j) Cable BOQ worked out based on routing of cable listing provided by the vendor for “ both end equipment in vendor’s scope”shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

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

Refer “Electrical Scope between BHEL and Vendor”.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

- 3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate.
- 3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

4.0 List of enclosures :

- a) Electrical scope between BHEL & vendor (Annexure –I)

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TITLE :

ELECTRICAL EQUIPMENT SPECIFICATION**MISC PUMPS****4 X 250MW NABINAGAR -FGD****3 X 660MW NABINAGAR-I FGD**

SPECIFICATION NO.

VOLUME NO. : **II-B**SECTION : **I**REV NO. : **00** DATE : **04.10.2021**

SHEET : 3 OF 3

- b) Technical specification for motors.
- c) Datasheets & quality plan for motors.
- d) Electrical Load data format (Annexure –II)
- e) BHEL cable listing format (Annexure –III)

597366/2021/PS-PEM-MSE

REV: 0 DATE: 04.10.2021

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR(FOR EPC PROJECTS)**PACKAGE: MISC. PUMP****SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT****PROJECT: 4 X 250MW NABINAGAR -FGD, 3 X 660MW NABINAGAR-I FGD**

<u>S.NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1	415 V MCC	BHEL	BHEL	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	BHEL	Located near the motors.
3	Power cables, control cables and screened control cables	BHEL	BHEL	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	BHEL	BHEL	
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	BHEL	
7	Equipment grounding & lightning protection	BHEL	BHEL	
8	Below grade grounding	BHEL	BHEL	
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.

SUB-SECTION-II-E2**MOTORS**

LOT-IA PROJECTS
FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE


TECHNICAL SPECIFICATION
SECTION-VI
BID DOCUMENT NO.: CS-0011-109(1A)-2

21/PS-REM-MSE		TECHNICAL REQUIREMENTS		<div>एनटीपीसी NTPC</div>	
		MOTORS			
1.00.00	GENERAL REQUIREMENTS				
1.01.00	For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment.				
1.02.00	All equipment's shall be suitable for rated frequency of 50 Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.				
1.03.00	Contactor shall provide fully compatible electrical system, equipment's, accessories and services.				
1.04.00	All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.				
1.05.00	Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.				
1.06.00	The responsibility of coordination with electrical agencies and obtaining all necessary clearances for Contactors equipment and systems shall be under the Contactor scope.				
1.07.00	Degree of Protection				
	Degree of protection for various enclosures as per IEC60034-05 shall be as follows :-				
	i)	Indoor motors	-	IP 54	
	ii)	Outdoor motors	-	IP 55	
	iii)	Cable box-indoor area	-	IP 54	
	iv)	Cable box-Outdoor area	-	IP 55	
2.00.00	CODES AND STANDARDS				
	1)	Three phase induction motors	:	IS/IEC:60034	
	2)	Single phase AC motors	:	IS/ IEC:60034	
	3)	Crane duty motors	:	IS:3177, IS/IEC:60034	
	4)	DC motors/generators	:	IS:4722, IS/IEC:60034	
	5)	Energy Efficient motors	:	IS 12615, IEC:60034-30	
LOT-IA PROJECTS FLUE GAS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION - VI, PART-B BID DOC NO : CS-0011-109(1)-2		SUB SECTION-II-E2 MOTORS	
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CLASS NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC
3.00.00	TYPE	
3.01.00	AC Motors: <ol style="list-style-type: none"> Squirrel cage induction motor suitable for direct-on-line starting. Continuous duty LT motors upto 200 KW Output rating (at 50 deg.C ambient temperature), shall be Premium Efficiency class-IE3, conforming to IS 12615, or IEC:60034-30. Crane duty motors shall be slip ring/ squirrel cage Induction motor as per the requirement. Motor operating through variable frequency drives shall be suitable for inverter duty. Also these motors shall comply the requirements stipulated in IEC: 60034-18-41 and IEC: 60034-18-42 as applicable. 	
3.02.00	DC Motors Shunt wound.	
4.00.00	RATING <ol style="list-style-type: none"> Continuously rated (S1). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor. Whenever the basis for motor or driven equipment ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations. 	
5.00.00	TEMPERATURE RISE Air cooled motors 70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation. Water cooled 80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation.	
6.00.00	OPERATIONAL REQUIREMENTS	
6.01.00	Starting Time	
6.01.01	For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.	
6.01.02	For motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than starting time.	
LOT-IA PROJECTS FLUE GAS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(1)-2 SUB SECTION-II-E2 MOTORS PAGE 2 OF 9

CLASS NO.	TECHNICAL REQUIREMENTS	एनडीपीसी NTPC
6.01.03	For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.	
6.01.04	Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.	
6.02.00	Torque Requirements	
6.02.01	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.	
6.02.02	Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.	
6.03.00	Starting voltage requirement (a) Up to 85% of rated voltage for ratings below 110 KW (b) Up to 80% of rated voltage for ratings from 110 KW to 200 KW (c) Up to 85% of rated voltage for ratings from 201 KW to 1000 KW (d) Up to 80% of rated voltage for ratings from 1001 KW to 4000 KW (e) Up to 75 % of rated voltage for ratings above 4000KW	
7.00.00	DESIGN AND CONSTRUCTIONAL FEATURES	
7.01.00	Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided. However for flame proof motors, space heater terminals inside the main terminal box may be acceptable.	
7.02.00	All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). The method of movement of primary and secondary coolant shall be self-circulated by fan or pump directly mounted on the rotor of the main motor as per IEC 60034-6. However VFD driven motors can be offered with forced cooling type with machine mounted fan or pump driven by separate electric motor. Motors and EPB located in hazardous areas shall have flame proof enclosures conforming to IS:2148 as detailed below (a) Fuel oil area : Group – IIB (b) Hydrogen generation : Group - IIC or (Group-I, Div-II as per plant area NEC) or (Class-1, Group-B, Div-II as per NEMA /IEC60034)	
LOT-IA PROJECTS FLUE GAS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(1)-2	SUB SECTION-II-E2 MOTORS PAGE 3 OF 9

CLASS NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
7.03.00	<p>Winding and Insulation</p> <p>(a) Type : Non-hygroscopic, oil resistant, flame resistant</p> <p>(b) Starting duty : Two hot starts in succession, with motor initially at normal running temperature.</p> <p>(c) 11kV & 3.3 kV AC motors : Thermal class 155 (F) insulation. The winding insulation process shall be total Vacuum Pressure Impregnated i.e resin poor method. The lightning Impulse & interturn insulation surge withstand level shall be as per IEC-60034 part-15.</p> <p>(d) 240VAC, 415V AC & 220V DC motors : Thermal Class (B) or better</p>			
7.04.00	Motors rated above 1000KW shall have insulated bearings to prevent flow of shaft currents.			
7.05.00	Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.			
7.06.00	Noise level for all the motors shall be limited to 85 dB(A) except for BFP motor for which the maximum limit shall be 90dB(A). Vibration shall be limited within the limits prescribed in IS:12075 / IEC 60034-14 . Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.			
7.07.00	In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer with adjustable alarm contact and preferably 2 numbers duplex platinum resistance type temperature detectors.			
7.08.00	Motor body shall have two earthing points on opposite sides.			
7.09.00	11 KV motors shall be offered with Separable Insulated Connector (SIC) as per IEEE 386. The offered SIC terminations shall be provided with protective cover and trifurcating sleeves. SIC termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.			
7.10.00	3.3 KV motors shall be offered with dust tight phase separated double walled (metallic as well as insulated barrier) Terminal box. Employer shall provide termination kit for the offered Terminal box. The offered Terminal Box shall be suitable for fault level of 250 MVA for 0.12 sec. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) shall be provided.			
LOT-IA PROJECTS FLUE GAS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION - VI, PART-B BID DOC NO : CS-0011-109(1)-2	SUB SECTION-II-E2 MOTORS	PAGE 4 OF 9

CLASS NO.	TECHNICAL REQUIREMENTS	
7.11.00	The spacing between gland plate & centre of terminal stud shall be as per Table-I.	
7.12.00	All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.	
7.13.00	The motors shall be suitable for bus transfer schemes provided on the 11kV, 3.3 kV /415V systems without any injurious effect on its life.	
7.14.00	For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.	
7.15.00	The size and number of cables (for HT motors) to be intimated to the successful Contactor during detailed engineering and the Contactor shall provide terminal box suitable for the same.	
8.00.00	<p>The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance):</p> <p>(a) From 50KW & upto 110KW : 11.0</p> <p>(b) From 110 KW & upto 200 KW : 9.0</p> <p>(c) Above 200 KW & upto 1000KW : 10.0</p> <p>(d) From 1001KW & upto 4000KW : 9.0</p> <p>(e) Above 4000KW : 6 to 6.5</p>	
10.00.00	TYPE TEST	
10.01.00	HT MOTORS	
10.01.01	The Contactor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The Contactor shall indicate the charges for each of these type tests separately in the relevant schedule of Section - VII- (BPS) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the Employer's engineer.	
10.01.02	The type tests shall be carried out in presence of the Employer's representative, for which minimum 15 days notice shall be given by the Contactor. The Contactor shall obtain the Employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set-up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.	
10.01.03	In case the Contactor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering	
LOT-IA PROJECTS FLUE GAS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION - VI, PART-B BID DOC NO : CS-0011-109(1)-2	SUB SECTION-II-E2 MOTORS PAGE 5 OF 9

CLASS NO.	TECHNICAL REQUIREMENTS
<p>10.01.04</p> <p>10.01.05</p> <p>10.01.06</p>	<p>the type test reports to the Employer for waiver of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The Employer reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the Contactor.</p> <p>Further the Contactor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED" and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the Contactor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the Contactor shall conduct all such tests under this contract at no additional cost to the Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval.</p> <p>LIST OF TYPE TESTS TO BE CONDUCTED</p> <p>The following type tests shall be conducted on each type and rating of HT motor</p> <p>(a) No load saturation and loss curves upto approximately 115% of rated voltage</p> <p>(b) Measurement of noise at no load.</p> <p>(c) Momentary excess torque test (subject to test bed constraint).</p> <p>(d) Full load test(subject to test bed constraint)</p> <p>(e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp.,coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.</p> <p>LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED</p> <p>The following type test reports shall be submitted for each type and rating of HT motor</p> <p>(a) Degree of protection test for the enclosure followed by IR, HV and no load run test.</p>
<p>LOT-IA PROJECTS FLUE GAS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION - VI, PART-B BID DOC NO : CS-0011-109(1)-2</p> <p>SUB SECTION-II-E2 MOTORS</p> <p>PAGE 6 OF 9</p>

CLASS NO.	TECHNICAL REQUIREMENTS	
	<p>(b) Terminal box-fault level withstand test for each type of terminal box of HT motors only.</p> <p>(c) Lightning Impulse withstand test on the sample coil shall be as per clause no. 4.3 IEC-60034, part-15</p> <p>(d) Surge-withstand test on inter-turn insulation shall be as per clause no. 4.2 of IEC 60034, part-15</p>	
10.02.00	LT Motors	
10.02.01	<p>LT Motors supplied shall be of type tested design. During detailed engineering, the Contactor shall submit for Employer's approval the reports of all the type tests as listed in this specification and carried out within last <i>ten</i> years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.</p>	
10.02.02	<p>However if the Contactor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the Contactor shall conduct all such tests under this contract at no additional cost to the Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval.</p>	
10.02.03	<p>LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED</p> <p>The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only</p> <ol style="list-style-type: none"> 1. Measurement of resistance of windings of stator and wound rotor. 2. No load test at rated voltage to determine input current power and speed 3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors) 4. Full load test to determine efficiency power factor and slip 5. Temperature rise test 6. Momentary excess torque test. 7. High voltage test 8. Test for vibration severity of motor. 9. Test for noise levels of motor(Shall be limited as per clause no 7.06.00 of this section) 	
<p>LOT-IA PROJECTS FLUE GAS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION ~ VI, PART-B BID DOC NO : CS-0011-109(1)-2</p>	<p>SUB SECTION-II-E2 MOTORS</p> <p>PAGE 7 OF 9</p>

CLASS NO.	TECHNICAL REQUIREMENTS
<p>10.03.00</p> <p>10.04.00</p>	<p>10. Test for degree of protection and</p> <p>11. Overspeed test.</p> <p>12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1</p> <p>All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.</p> <p>The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.</p>
<p>LOT-IA PROJECTS FLUE GAS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p>	<p>TECHNICAL SPECIFICATION SECTION - VI, PART-B BID DOC NO : CS-0011-109(1)-2</p> <p>SUB SECTION-II-E2 MOTORS</p> <p>PAGE 8 OF 9</p>

TABLE - I

DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS

Motor MCR in KW of	Minimum distance between centre stud and gland plate in mm As per manufacturer's practice.
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UP to 3 KW

Above 3 KW - upto 7 KW	85
Above 7 KW - upto 13 KW	115
Above 13 KW - upto 24 KW	167
Above 24 KW - upto 37 KW	196
Above 37 KW - upto 55 KW	249
Above 55 KW - upto 90 KW	277
Above 90 KW - upto 125 KW	331
Above 125 KW-upto 200 KW	203

For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm.

PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:

NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:

Motor MCR in KW	Clearance
UP to 110 KW	10mm
Above 110 KW and upto 150 KW	12.5mm
Above 150 KW	19mm



LV MOTORS DATA SHEET-A

4 x 250MW NABINAGAR FGD
3 X 660MW NABINAGAR-I FGD

SPECIFICATION NO.

VOLUME II B

SECTION D

REV NO. DATE: 04.10.2021


SHEET 1 OF 2

ANNEXURE-III

- 1.0 Design ambient temperature : 50 °C
- 2.0 Maximum acceptable kW rating of LV motor : 200KW *
- 3.0 Installation (Indoors/ Outdoors) : As required
- 4.0 Details of supply system
 - a) Rated voltage (with variation) : 415V \pm 10%
 - b) Rated frequency (with variation) : 50 Hz + 3 % to - 5%
 - c) Combined voltage & freq. variation : 10% (sum of absolute values)
 - d) System fault level at rated voltage : 50 kA for 1 sec
 - e) Short time rating for terminal boxes
 - o 110 kW and above (Breaker : 50 KA for 0.25 sec. Controlled)
 - o Below 110 kW (Contactor : 50 KA protected by HRC fuse Controlled)
 - f) LV System grounding : Solidly
- 5.0 Winding & Insulation : Class F with temp rise limited to class B
- 6.0 Minimum voltage for starting : 85% for motor ratings below 110kW
(As percentage of rated voltage) 80% for motor ratings from 110kW to 200kW.
- 7.0 Power cables data : Shall be given during detailed engg.
- 8.0 Earth Conductor Size & Material : Shall be given during detailed engg.
- 9.0 Space heater supply (for motors \geq 30kW) : 240 V, 1 ϕ , 50 Hz
- 10.0 Rating up to which Single phase motor : Acceptable below 0.2 kW
- 11.0 Locked rotor current
 - a) Limit as percentage of FLC : As per IS 12615
- 12.0 Makes : BHEL/ Customer approval (Package owner to take care)
- 13.0 Paint shade : Blue (RAL 5012) – Corrosion proof
- 14.0 Degree Of protection for motor/ terminal box : Degree of protection for various enclosures as per IEC60034-05 shall be as follows:-
 - i) Indoor motors - IP 54
 - ii) Outdoor motors - IP 55
 - iii) Cable box-indoor area - IP 54
 - iv) Cable Box-Outdoor area - IP 55

*** LT motors of continuous duty shall be energy efficient IE3 class conforming to IS-12615**


15.0 TESTING REQUIREMENTS: IN LINE WITH SPECIFICATION

CLAUSE NO.	TECHNICAL REQUIREMENTS	
3.06.00	Cable glands	
3.06.01	Cable shall be terminated using double compression type cable glands. Testing requirements of Cable glands shall conform to BS:6121 and gland shall be of robust construction capable of clamping cable and cable armour (for armoured cables) firmly without injury to insulation. Cable glands shall be made of heavy duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall also be made of brass with nickel chrome plating Rubber components shall be of neoprene or better synthetic material and of tested quality. Cable glands shall be suitable for the sizes of cable supplied/erected.	
3.07.00	Cable lugs/ferrules	
3.07.01	Cable lugs/ferrules for power cables shall be tinned copper solderless crimping type suitable for aluminium compacted conductor cables. Cable lugs and ferrules for control cables shall be tinned copper type. The cable lugs for control cables shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipments. Cable lugs and ferrule shall conform to IS/DIN standards.	
3.08.00	Trefoil clamps	
3.08.01	Trefoil clamps for single core cables shall be pressure die cast aluminum or fibre glass or nylon and shall include necessary fixing accessories like G.I. nuts, bolts, washers, etc. Trefoil clamps shall have adequate mechanical strength, when installed at 1 mtr intervals, to withstand the forces generated by the peak value of maximum system short circuit current.	
3.09.00	Cable Clamps & Ties	
3.09.01	The cable clamps/ties required to clamp multicore cables shall be of SS-316 material, 12mm wide, polyester coated ladder lock type. The clamps/ties shall have self locking arrangement & shall have sufficient strength. The cable clamps/ties shall be supplied in finished individual pieces of suitable length to meet the site requirements.	
3.10.00	Receptacles	
3.10.01	Receptacles boxes shall be fabricated out of MS sheet of 2mm thickness and hot dipped gavanised or of die-cast aluminium alloy of thickness not less than 2.5 mm. The boxes shall be provided with two nos. earthing terminals, gasket to achieve IP55 degree of protection, terminal blocks for loop-in loop-out for cable of specified sizes, mounting brackets suitable for surface mounting on wall/column/structure, gland plate etc. The ON-OFF switch shall be rotary type heavy duty, double break, AC23 category, suitable for AC supply. Plug and Socket shall be shrouded Die-cast aluminium. Socket shall be provided with lid safety cover. Robust mechanical interlock shall be provided such that the switch can be put ON only when the plug is fully engaged and plug can be withdrawn only when the switch is in OFF position. Also cover can be opened only when the switch is in OFF position. Wiring shall be carried out with 1100 V grade PVC insulated stranded aluminium/copper wire of adequate size. The Terminal blocks shall be of 1100 V grade. The Terminal blocks shall be of 1100 V grade made up of unbreakable polyimide 6.6 grade with adequate current rating and size. The welding receptacles shall be provided with inbuilt ELCB rated for suitable mA sensitivity ranging from 30-300 mA .	
3.11.00	Cable Drum Lifting Jack The jack for cable drum lifting shall be of screw type with 10 ton capacity. The cable drum jacks shall be manufactured from fabricated steel. The spindles supplied with the cable drum jack shall be manufactured using BSEN-24 grade steel bar with locking collars. Jack nests shall be of SG cast steel. Cable drum jack supplied shall have undergone load testing and reports for the same shall be submitted. At least Two Nos. of jacks shall be supplied for	
LOT-4A PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION - VI, PART-B BID DOC NO : CS-0011-109(1A)-2	SUB SECTION-II-E6 CABLING, EARTHING & LIGHTNING PROTECTION Page 7 of 69

SUB-SECTION-V-QE1**MOTORS**


LOT-IA PROJECTS
FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE

TECHNICAL SPECIFICATION
SECTION-VI
BID DOCUMENT NO.: CS-0011-109(1A)-2

CLAUSE NO.		QUALITY ASSURANCE																					
MOTOR																		SUB-SECTION-V-QE1 MOTORS				PAGE 1 OF 2	
TESTS/CHECKS		Visual	Dimensional	Make/Type/Rating /General	Mech/Chem. Properties	NDT /DP/MP/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment	Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	Routine & Acceptance tests as per IS-325/IS-4722 /IS- 9283/IS-2148/IEC60034/IEC 60079-II /IS-12615	Vibration	Over speed	Tan delta, shaft voltage & polarization index test	Paint shade, thickness & adhesion			
TEMS/COMPONENTS																							
Plates for stator frame, end shield, spider etc.		Y	Y	Y	Y	Y	Y		Y	Y													
Shaft		Y	Y	Y	Y	Y	Y		Y	Y													
Magnetic Material		Y	Y	Y	Y			Y			Y												
Rotor Copper/Aluminium		Y	Y	Y	Y			Y		Y													
Stator copper		Y	Y	Y	Y			Y		Y													
SC Ring		Y	Y	Y	Y	Y		Y	Y	Y													
Insulating Material		Y		Y	Y	Y		Y		Y													
Tubes, for Cooler		Y	Y	Y	Y	Y				Y		Y											
Sleeve Bearing		Y	Y	Y	Y	Y				Y		Y											
Stator/Rotor, Exciter Coils		Y	Y	Y	Y	Y		Y	Y	Y													
Castings, stator frame, terminal box and bearing housing etc.		Y	Y	Y	Y	Y			Y														
Fabrication & machining of stator, rotor, terminal box		Y	Y			Y			Y	Y													

CLAUSE NO.		QUALITY ASSURANCE																	
		<div><div></div><div>NTPC</div></div>																	
		Wound stator	Y	Y						Y	Y								
		Wound Exciter	Y	Y						Y	Y								
		Rotor complete	Y	Y						Y				Y					
		Exciter, Stator, Rotor, Terminal Box assembly	Y	Y						Y									
		Accessories, RTD, BTD, CT, Space heater, antifriction bearing, gaskets etc.	Y	Y	Y														
		Complete Motor	Y	Y	Y										Y	Y	Y	Y1	Y
		Note: 1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, No QP for LT motor upto 50KW. 2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard 3. Makes of major bought out items for HT motors will be subject to NTPC approval. 4. Y1 = for HT Motor / Machines only.																	
LOT-IA PROJECTS FLUE GAS DESULPHURISATION SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO CS-0011-109(1A)-2										SUB-SECTION-V-QE1 MOTORS					PAGE 2 OF 2		


597366/2021/PS-PEM-MSE

	TITLE: TECHNICAL SPECIFICATION MISCELLANEOUS PUMPS SPECIFIC TECHNICAL REQUIREMENTS	SPEC. NO.: PE-TS-457/463-100-N001	
		SECTION: I	
		SUB-SECTION: ID	
		REV. NO. 00	DATE 14.12.2021
		SHEET 1	OF 1

SUB-SECTION – IC

SPECIFIC TECHNICAL REQUIREMENTS (C&I)

597366/2021/PS-PEM-MSE

	TITLE: TECHNICAL SPECIFICATION MISCELLANEOUS PUMPS SPECIFIC TECHNICAL REQUIREMENTS	SPEC. NO.: PE-TS-457/463-100-N001	
		SECTION: I	
		SUB-SECTION: ID	
		REV. NO. 00	DATE 14.12.2021
		SHEET 1	OF 1

SUB-SECTION – ID**DATASHEET-A**

597366/2021/PS-PEM-MSE

DATA SHEET - A

SPECIFICATION NO:
PE-TS-457/463-100-N001, REV-0

MISCELLANEOUS PUMPS (HORIZONTAL)

SECTION: I D

REV : 00, DATED 14.12.2021

HORIZONTAL CENTRIFUGAL PUMPS

PROJECT:

NPGCPL 3X660 MW NABINAGAR -FGD PROJECT

Sl. No.	DESCRIPTION	ECW (DMCW) PUMPS	ACW PUMPS
		HORIZONTAL PUMPS	HORIZONTAL PUMPS
1.0	SERVICE		
1.1	Total number of Pumps for Project	4	5
1.2	Number of working(W) & Standby(S) pumps	3W+1S	3W+2S
1.3	Liquid Handled (refer water analysis enclosed herein)	pH corrected DM Water	Clarified water /CW Blowdown water
1.4	Location (Indoor / Outdoor)	Outdoor	Outdoor
1.5	Duty	Continuous	Continuous
1.6	No. of pumps working in parallel	3	3
1.7	Specific gravity	1	1
1.8	System design pressure (kg/sq. cm), g	10	7.5
2.0	DESIGN PARAMETERS		
2.1	Design/Rated capacity each, M ³ /hr	125	160
2.2	Total dynamic head (MWC) at Rated Capacity	70	40
2.3	Suction Pressure(MWC)	10	Flooded suction
2.4	Design Temperature (°C)	60	60
2.5	Maximum permissible speed of pump (RPM)	1500	1500
2.6	Max. limit on shut off head Corresponding to pump TDH (MWC) at 51.5 Hz	Not to exceed 84 MWC	Not to exceed 55 MWC
2.7	Operating range	-----30-130% of design duty point flow-----	
2.8	Motor rating	Continuous Motor rating (at 50 deg. C ambient) shall be at least ten percent (10%)above the maximum load demand of the pump in the entire characteristic curve of the pump to take care of the system frequency variation. The KW rating of the drive unit shall be based on continuously driving the connected equipment for the conditions specified. However, in cases where parallel operation of the pumps are specified, the actual motor rating is to be selected by the Bidder considering overloading of the pumps in the event of tripping of operating pump(s).	
2.9	Permissible tolerance in rated capacity & TDH	no negative tolerance	
2.10	Permissible tolerance in efficiency at rated capacity(%)	no negative tolerance	
2.11	Performance/Design Standard	HIS	
3.0	CONSTRUCTION FEATURES		
3.1	Pump type	Horizontal centrifugal type	Horizontal centrifugal type
3.2	Impeller type	Closed	Closed
3.3	Casing type	Horizontal Axial split type	Horizontal Axial split type
3.4	Coupling type	Flexible Spacer type	Flexible Spacer type
3.5	Sealing arrangement	Gland packing initially & Mechanical seal finally after commisioning	Gland Packing
3.6	Type of Lubrication	Grease / Self Liquid	Grease / Self Liquid

597366/2021/PS-PEM-MSE

DATA SHEET - A

SPECIFICATION NO:
PE-TS-457/463-100-N001, REV-0

MISCELLANEOUS PUMPS (HORIZONTAL)

SECTION: I D

REV : 00, DATED 14.12.2021

HORIZONTAL CENTRIFUGAL PUMPS

PROJECT:

NPGCPL 3X660 MW NABINAGAR -FGD PROJECT

Sl. No.	DESCRIPTION	ECW (DMCW) PUMPS	ACW PUMPS
3.7	Pump characteristics	Non Overloading type & stable	Non Overloading type & stable
3.8	Drain Plugs, vent with valve, lifting lugs, priming connection, coupling guard, Positioning dowels, Companion flanges with nuts, bolts & gaskets	Required	Required
4.0	MATERIALS OF CONSTRUCTION		
4.1	Casing	ASTM – A351 – CF8M	2.5% Ni Cl to IS: 210 Gr FG-260
4.2	Impeller	ASTM – A351 – CF8M	Bronze to IS 318 Gr. I/II or CF8M
4.3	Shaft	SS 316	SS 316
4.4	Shaft Sleeves	SS 410	SS 410
4.5	Impeller Wearing rings	SS 316	High leaded Bronze to IS -318 GR. V or SS-316 in case of SS impeller
4.6	All Fasteners	Stainless Steel	Stainless Steel
4.7	Gland/Seal Cover	SS 316	2.5% Ni Cl to IS: 210 Gr FG-260
4.8	Lantern Ring	SS 316	Bronze
4.9	Mech. seal	Manufacturer standard	NA
4.10	Gland Packing	Teflon Impregnated (Asbestos Free)	Teflon Impregnated (Asbestos Free)
4.11	Base Plate	MS fabricated IS-2062 (min. thk.-10 mm) Epoxy Coated	
4.12	Stuffing Box	ASTM A 351 CF 8M	2.5% Ni Cl to IS: 210 Gr FG-260
4.13	Casing Wearing rings (If applicable)	SS 316	High Leaded Bronze to IS 318 Gr. V/ SS 316 in case of SS impeller.
4.14	Coupling	CI	CI
4.15	Connecting Pipe material (for deciding counterflange material)	Carbon Steel to IS 1239 (Heavy Grade) / IS:2062 GR. E 250B, Plates rolled & welded as per IS 3589.	Carbon Steel to IS 1239 (Heavy Grade) / IS:2062 GR. E 250B, Plates rolled & welded as per IS 3589.
5.0	MANDATORY SPARES FOR PUMP-MOTOR SET		
5.1	Impeller with nuts & other accessories	1 Set.	1 Set.
5.2	Impeller Wearing Ring (as applicable)	2 Sets	2 Sets
5.3	Casing Wearing Ring (as applicable)	2 Sets	2 Sets
5.4	Shaft	1 Set	1 Set
5.5	Shaft Sleeves (DE & NDE)	2 Sets	2 Sets
5.6	Pump & Drive Coupling, bushes, pins with all fasteners	1 Set	1 Set
5.7	Pump bearings	1 Set	1 Set
5.8	Mechanical Seal (both DE and NDE) (if applicable)	1 Set	1 Set
	Mandatory Spare Note: 1. One(1) set consists of quantity required for complete replacement for one(1) Pump of each type/size. Also the 'set' would include all components/hardware required to replace the item. 2. In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities as specified in the Datasheet A.		

597366/2021/PS-PEM-MSE

	DATA SHEET - A		SPECIFICATION NO: PE-TS-457/463-100-N001, REV-0
	MISCELLANEOUS PUMPS (HORIZONTAL)		SECTION: I D
			REV : 00, DATED 14.12.2021
	HORIZONTAL CENTRIFUGAL PUMPS		
	PROJECT:	NPGCPL 3X660 MW NABINAGAR -FGD PROJECT	
Sl. No.	DESCRIPTION	ECW (DMCW) PUMPS	ACW PUMPS
6.0	BID EVALUATION RATE		
6.1	Bid evaluation rate	INR 1.75 Lacs/KW	INR 1.75 Lacs/KW
6.2	Maximum permissible efficiency for Bid evaluation		
6.2.1	Pump Efficiency	60	70
6.2.2	Motor Efficiency	93.8	93
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.		

597366/2021/PS-PEM-MSE

	DATA SHEET - A		SPECIFICATION NO: PE-TS-457/463-100-N001, REV-0
	MISCELLANEOUS PUMPS (HORIZONTAL)		SECTION: I D
			REV : 00, DATED 14.12.2021
	HORIZONTAL CENTRIFUGAL PUMPS		
	PROJECT:	BRBCL 4X250 MW NABINAGAR TPP -FGD PROJECT	
Sl. No.	DESCRIPTION	ECW (DMCW) PUMPS	ACW PUMPS
		HORIZONTAL PUMPS	HORIZONTAL PUMPS
1.0	SERVICE		
1.1	Total number of Pumps for Project	5	6
1.2	Number of working(W) & Standby(S) pumps	4W+1S	4W+2S
1.3	Liquid Handled (refer water analysis enclosed herein)	pH corrected DM Water	Clarified water /CW Blowdown water
1.4	Location (Indoor / Outdoor)	Outdoor	Outdoor
1.5	Duty	Continuous	Continuous
1.6	No. of pumps working in parallel	4	4
1.7	Specific gravity	1	1
1.8	System design pressure (kg/sq. cm), g	12	7.5
2.0	DESIGN PARAMETERS		
2.1	Design/Rated capacity each, M ³ /hr	47	65
2.2	Total dynamic head (MWC) at Rated Capacity	70	35
2.3	Suction Pressure(MWC)	10	Flooded suction
2.4	Design Temperature (°C)	60	60
2.5	Maximum permissible speed of pump (RPM)	1500	1500
2.6	Max. limit on shut off head Corresponding to pump TDH (MWC) at 51.5 Hz	Not to exceed 90 MWC	Not to exceed 50 MWC
2.7	Operating range	-----30-130% of design duty point flow-----	
2.8	Motor rating	Continuous Motor rating (at 50 deg. C ambient) shall be at least ten percent (10%)above the maximum load demand of the pump in the entire characteristic curve of the pump to take care of the system frequency variation. The KW rating of the drive unit shall be based on continuously driving the connected equipment for the conditions specified. However, in cases where parallel operation of the pumps are specified, the actual motor rating is to be selected by the Bidder considering overloading of the pumps in the event of tripping of operating pump(s).	
2.9	Permissible tolerance in rated capacity & TDH	no negative tolerance	
2.10	Permissible tolerance in efficiency at rated capacity(%)	no negative tolerance	
2.11	Performance/Design Standard	HIS	
3.0	CONSTRUCTION FEATURES		
3.1	Pump type	Horizontal centrifugal type	Horizontal centrifugal type
3.2	Impeller type	Closed	Closed
3.3	Casing type	Horizontal Axial split type	Horizontal Axial split type
3.4	Coupling type	Flexible Spacer type	Flexible Spacer type
3.5	Sealing arrangement	Gland packing initially & Mechanical seal finally after commissioning	Gland Packing
3.6	Type of Lubrication	Grease / Self Liquid	Grease / Self Liquid

597366/2021/PS-PEM-MSE

DATA SHEET - A

SPECIFICATION NO:
PE-TS-457/463-100-N001, REV-0

MISCELLANEOUS PUMPS (HORIZONTAL)

SECTION: I D

REV : 00, DATED 14.12.2021

HORIZONTAL CENTRIFUGAL PUMPS

PROJECT:

BRBCL 4X250 MW NABINAGAR TPP -FGD PROJECT

Sl. No.	DESCRIPTION	ECW (DMCW) PUMPS	ACW PUMPS
3.7	Pump characteristics	Non Overloading type & stable	Non Overloading type & stable
3.8	Drain Plugs, vent with valve, lifting lugs, priming connection, coupling guard, Positioning dowels, Companion flanges with nuts, bolts & gaskets	Required	Required
4.0	MATERIALS OF CONSTRUCTION		
4.1	Casing	ASTM – A351 – CF8M	2.5% Ni Cl to IS: 210 Gr FG-260
4.2	Impeller	ASTM – A351 – CF8M	Bronze to IS 318 Gr. I/II or CF8M
4.3	Shaft	SS 316	SS 316
4.4	Shaft Sleeves	SS 410	SS 410
4.5	Impeller Wearing rings	SS 316	High leaded Bronze to IS -318 GR. V or SS-316 in case of SS impeller
4.6	All Fasteners	Stainless Steel	Stainless Steel
4.7	Gland/Seal Cover	SS 316	2.5% Ni Cl to IS: 210 Gr FG-260
4.8	Lantern Ring	SS 316	Bronze
4.9	Mech. seal	Manufacturer standard	NA
4.10	Gland Packing	Teflon Impregnated (Asbestos Free)	Teflon Impregnated (Asbestos Free)
4.11	Base Plate	MS fabricated IS-2062 (min. thk.-10 mm) Epoxy Coated	
4.12	Stuffing Box	ASTM A 351 CF 8M	2.5% Ni Cl to IS: 210 Gr FG-260
4.13	Casing Wearing rings (If applicable)	SS 316	High Leaded Bronze to IS 318 Gr. V/ SS 316 in case of SS impeller.
4.14	Coupling	Cl	Cl
4.15	Connecting Pipe material (for deciding counterflange material)	Carbon Steel to IS 1239 (Heavy Grade) / IS:2062 GR. E 250B, Plates rolled & welded as per IS 3589.	Carbon Steel to IS 1239 (Heavy Grade) / IS:2062 GR. E 250B, Plates rolled & welded as per IS 3589.
5.0	MANDATORY SPARES FOR PUMP-MOTOR SET		
5.1	Impeller with nuts & other accessories	1 Set.	1 Set.
5.2	Impeller Wearing Ring (as applicable)	2 Sets	2 Sets
5.3	Casing Wearing Ring (as applicable)	2 Sets	2 Sets
5.4	Shaft	1 Set	1 Set
5.5	Shaft Sleeves (DE & NDE)	2 Sets	2 Sets
5.6	Pump & Drive Coupling, bushes, pins with all fasteners	1 Set	1 Set
5.7	Pump bearings	1 Set	1 Set
5.8	Mechanical Seal (both DE and NDE) (if applicable)	1 Set	1 Set
	Mandatory Spare Note: 1. One(1) set consists of quantity required for complete replacement for one(1) Pump of each type/size. Also the 'set' would include all components/hardware required to replace the item. 2. In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities as specified in the Datasheet A.		

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	DATA SHEET - A		SPECIFICATION NO: PE-TS-457/463-100-N001, REV-0
	MISCELLANEOUS PUMPS (HORIZONTAL)		SECTION: I D
			REV : 00, DATED 14.12.2021
	HORIZONTAL CENTRIFUGAL PUMPS		
	PROJECT:	BRBCL 4X250 MW NABINAGAR TPP -FGD PROJECT	
Sl. No.	DESCRIPTION	ECW (DMCW) PUMPS	ACW PUMPS
6.0	BID EVALUATION RATE		
6.1	Bid evaluation rate	INR 1.5 Lacs/KW	INR 1.5 Lacs/KW
6.2	Maximum permissible efficiency for Bid evaluation		
6.2.1	Pump Efficiency	45	70
6.2.2	Motor Efficiency	92.6	90.9
Notes :			
1	Material of construction for other components not specified above shall be similarly selected in line with the above for the duty intended and subject to approval.		
2	For items stated as not applicable by bidder, shall have to be supplied without any cost implication to BHEL in the event they are found to be applicable during detail engineering stage.		
3	For all HT motor driven pumps (wherever applicable), bidder shall provide flat surface with dimensions 60 MM x60 MM on bearing Housing for mounting vibration measuring block and a key slots of dimensions 30MM (L) X 15 MM (W) X 3 MM (D) on each pump shaft or some other suitable location which shall be confirmed during detail engineering by BHEL for Phase Marker.		
4	Wherever SS material is coming in contact with non SS material, suitable isolation (rubber etc.) shall be provided to avoid galvanic corrosion.		

CLAUSE NO.	PROJECT INFORMATION																																																																													
	<div>Table-3</div> <table><tr><th>S.No</th><th>Constituent</th><th>As</th><th>mg/l (except pH & turbidity)</th></tr><tr><td>1.</td><td>Calcium</td><td>CaCO₃</td><td>131</td></tr><tr><td>2.</td><td>Magnesium</td><td>CaCO₃</td><td>52</td></tr><tr><td>3.</td><td>Sodium + Potassium</td><td>CaCO₃</td><td>65</td></tr><tr><td>4.</td><td>Total Cations</td><td>CaCO₃</td><td>248</td></tr><tr><td>5.</td><td>Chloride</td><td>CaCO₃</td><td>20</td></tr><tr><td>6.</td><td>Sulphate</td><td>CaCO₃</td><td>93</td></tr><tr><td>7.</td><td>Nitrate</td><td>CaCO₃</td><td>10</td></tr><tr><td>8.</td><td>Alkalinity</td><td>CaCO₃</td><td>125</td></tr><tr><td>9.</td><td>Total Anions</td><td>CaCO₃</td><td>248</td></tr><tr><td>10.</td><td>Iron(total)</td><td>Fe</td><td>0.3</td></tr><tr><td>11.</td><td>Total Silica</td><td>SiO₂</td><td>22</td></tr><tr><td>12.</td><td>pH value</td><td>---</td><td>7.0-8.2</td></tr><tr><td>13.</td><td>Turbidity</td><td>NTU</td><td>10</td></tr></table> <p>Note: Clarified water is used for CW system as make up & the CW system is expected to operate at about 5.0 – 5.5 Cycles of Concentration (COC) with suitable chemical treatment program using acid, scale & corrosion inhibitor dosing. As CW blow down water is tapped from CW system, the water quality of CW blow down shall accordingly be arrived by the bidder.</p> <div>Table-4</div> <div>ANALYSIS OF DM WATER TO BE USED FOR MAKE-UP WATER TO CONDENSER</div> <table><tr><th>Sl.No.</th><th>Characteristics</th><th>Value</th></tr><tr><td>1.</td><td>Silica (Max.)</td><td>0.02 ppm as Sio2</td></tr><tr><td>2.</td><td>Iron as Fe</td><td>Nil</td></tr><tr><td>3.</td><td>Total hardness</td><td>Nil</td></tr><tr><td>4.</td><td>pH value</td><td>6.8 -7.2</td></tr><tr><td>5.</td><td>Conductivity</td><td>Not more than 0.1 micro mhos/cm excluding the effects of free CO2</td></tr></table>				S.No	Constituent	As	mg/l (except pH & turbidity)	1.	Calcium	CaCO ₃	131	2.	Magnesium	CaCO ₃	52	3.	Sodium + Potassium	CaCO ₃	65	4.	Total Cations	CaCO ₃	248	5.	Chloride	CaCO ₃	20	6.	Sulphate	CaCO ₃	93	7.	Nitrate	CaCO ₃	10	8.	Alkalinity	CaCO ₃	125	9.	Total Anions	CaCO ₃	248	10.	Iron(total)	Fe	0.3	11.	Total Silica	SiO ₂	22	12.	pH value	---	7.0-8.2	13.	Turbidity	NTU	10	Sl.No.	Characteristics	Value	1.	Silica (Max.)	0.02 ppm as Sio2	2.	Iron as Fe	Nil	3.	Total hardness	Nil	4.	pH value	6.8 -7.2	5.	Conductivity	Not more than 0.1 micro mhos/cm excluding the effects of free CO2
	S.No	Constituent	As	mg/l (except pH & turbidity)																																																																										
	1.	Calcium	CaCO ₃	131																																																																										
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5.	Conductivity	Not more than 0.1 micro mhos/cm excluding the effects of free CO2																																																																												
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOC. NO.:CS-0011-109(1A)-2	SUB SECTION-II-A8 PROJECT INFORMATION NABINAGAR STPP-I (3X660MW)	PAGE - 29 - OF 31																																																																										

CLAUSE NO.	PROJECT INFORMATION			<div>एनटीपीसी NTPC</div>
	Table-3			
	DESIGN CLARIFIED WATER ANALYSIS			
	S.No	Constituent	As	mg/l (except pH & turbidity)
	1.	Calcium	CaCO ₃	131
	2.	Magnesium	CaCO ₃	52
	3.	Sodium + Potassium	CaCO ₃	65
	4.	Total Cations	CaCO ₃	248
	5.	Chloride	CaCO ₃	20
	6.	Sulphate	CaCO ₃	93
	7.	Nitrate	CaCO ₃	10
	8.	Alkalinity	CaCO ₃	125
	9.	Total Anions	CaCO ₃	248
	10.	Iron(total)	Fe	0.3
	11.	Total Silica	SiO ₂	22
	12.	pH value	---	7.0-8.2
13.	Turbidity	NTU	10	
<p>Note: Clarified water is used for CW system as make up & the CW system is expected to operate at about 5.0 – 5.5 Cycles of Concentration (COC) with suitable chemical treatment program using acid, scale & corrosion inhibitor dosing. As CW blow down water is tapped from CW system, the water quality of CW blow down shall accordingly be arrived by the bidder.</p>				
Table-4				
ANALYSIS OF DM WATER				
Sl.No.	Characteristics	Value		
1.	Silica (Max.)	0.02 ppm as SiO ₂		
2.	Iron as Fe	Nil		
3.	Total hardness	Nil		
4.	pH value	6.8 to 7.2		
5.	Conductivity	Not more than 0.1 µs/cm		
LOT-IA PROJECTS FLUE GAS DE-SULPHURIZATION (FGD) SYSTEM PACKAGE				
TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2				
SUB-SECTION-II-A11 PROJECT INFORMATION NABINAGAR TPP				
PAGE 27 OF 29				


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	TITLE: TECHNICAL SPECIFICATION MISCELLANEOUS PUMPS SPECIFIC TECHNICAL REQUIREMENTS	SPEC. NO.: PE-TS-457/463-100-N001		
		SECTION: II		
		SUB-SECTION: IIA		
		REV. NO. 00	DATE	14.12.2021
		SHEET 1	OF 1	


SUB-SECTION - IIA


STANDARD TECHNICAL SPECIFICATION (MECHANICAL)


- STANDARD TECHNICAL SPECIFICATION FOR MISC. PUMPS (HORIZONTAL) 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'.	

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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.		

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<p>e) Counter flanges for suction/ discharge nozzles along with fixing nuts, bolts and gaskets.</p> <p>f) Anchor bolts, nuts, seating steel works, shims etc. as necessary for mounting the pump-motor unit on civil foundations.</p> <p>g) Suitable vent (with valves)/ lifting/ handling attachments for the pump/ motor/ accessories.</p> <p>h) Suitable drain connections with isolating valves as applicable.</p> <p>i) Supply of first fill of lubricants with topping requirements for one year of operation after commissioning and handing over of equipment.</p> <p>j) Set of “Special” Tools & Tackles for Pumps and motors, if any.</p> <p>k) Erection and commissioning spares, “on as required” basis.</p> <p>l) Bidder shall provide various drawings, data, calculations, test reports/ certificates, operation and maintenance manuals, As-built drawings, etc. as specified and as necessary.</p> <p>m) Mandatory spares as specified in respective Data Sheet-A of this section.</p>			
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.		

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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:

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

4.00.00 BID EVALUATION CRITERIA & LIQUIDATED DAMAGES FOR SHORTFALL:


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


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


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


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

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

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<p>No advantage shall be given to the bidder for Aux. Power quoted lower than the Bench mark values calculated with KW calculation formula at Cl. 4.01.00 <i>above, considering the bid evaluation efficiencies for pump and motor as indicated in Data Sheet-A.</i> However the bids shall be evaluated as above if the Aux. Power quoted are higher than Bench mark values.</p> <p>NOTE:</p> <p>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.</p> <p>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:</p> <p>Revised guarantee power consumption shall be as per KW calculation formula at Cl. 4.01.00 <i>above, where P = pump efficiency guaranteed by bidder and M = motor efficiency as per approved datasheet of the supplied HT/LT motor.</i></p> <p>4.03.00 Liquidated damages for shortfall in Guaranteed KW</p> <p>The above guaranteed power consumption shall be demonstrated by the successful bidder during performance testing at works/ site.</p> <p>For pumps with BHEL supplied drives, the power consumption shall be compared with the reworked guarantee power consumption, defined as per note no. 2 of Cl. 4.02.00 above for the purpose of shortfall.</p> <p>The liquated damages @ twice the bid evaluation rate as above per KW per working pump shall be levied in the event of failure of bidder to demonstrate the guaranteed power consumption.</p> <p>5.00.00 TECHNICAL REQUIREMENTS:</p> <p>5.01.00 The pumps shall meet the technical requirements of Section-I as well as Section-II. In the event of any contradiction of Section-II with Section-I, the Section-I will prevail.</p> <p>5.02.00 The pumps shall be Electric motor driven.</p> <p>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.</p> <p>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.</p> <p>5.05.00 No negative tolerance shall be permitted in rated capacity & TDH.</p> <p>5.06.00 No negative tolerance shall be permitted in efficiency at rated capacity.</p>			

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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: <ul style="list-style-type: none">• 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


- The surface of SS, Gun metal, brass, bronze and non-metallic component shall not be applied with any painting.
- The Steel surface to be applied with painting shall be thoroughly cleaned before applying painting by brushing, shop blasting etc. as per the agreed procedure.
- For all the steel surfaces inside the (indoor installation) building, a coat of red oxide primes of min. thickness 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.
- For all the steel surfaces exposed to (outdoor installation) atmosphere, a coat of chlorinated rubber based zinc phosphate primer of min. thickness DFT of 50 microns followed up with under coat of chlorinated rubber paint of min. thickness DFT of 50 microns shall be applied. Then, intermediate coat consisting of one coat of chlorinated rubber based paint pigmented with Titanium di-oxide with min. thickness DFT of 50 microns and top coat shall consist of two coats each of min. thickness DFT of 50 microns of chlorinated rubber paint shall be provided. Total DFT of paint system shall be min. 200 microns.


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


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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 $\pm 10\%$ of the specified duty point flow. The pumps shall be suitable for continuous operation at any point within the "Range of Operation" as stipulated in the Data Sheet - A attached with Section-I.		
8.03.00	Pump(s) shall preferably have a continuously rising head-capacity characteristics from the specified duty point towards shut-off point, the maximum being at shut-off to enable parallel operation. Under all circumstances, the 'range of operation' of the pumps shall exclude any unstable operating zone of the head-capacity curve.		
8.04.00	Wherever specified in the Data Sheet - A, pumps of each category shall be suitable for parallel operation. The head vs. capacity, the BHP vs. capacity characteristics etc. shall be identical to ensure equal load sharing and trouble-free operation of any pump when the other pump(s) working in parallel with it trip.		
8.05.00	The pump set along with drive motor shall run smooth without undue noise and vibration. Acceptable vibration limits shall be guided by the HIS of USA. Refer clause 5.15.00 above for permissible limits.		
9.00.00	DESIGN AND CONSTRUCTION		
9.01.00	Pump Casing		
9.01.01	Pump casing shall be provided with adequate number of vents and priming connections with valves unless the pump is made self-venting and priming. Casing drain, as required, shall be provided complete with drain valves. It shall be provided with a connection for suction and discharge pressure gauge as standard feature.		
9.01.02	Pump design must ensure that the nozzles are capable of withstanding external reactions not less than those specified in API-610.		
9.01.03	In case where an expansion joint is located at pump discharge, the pump assembly will be subjected to an additional thrust which will be transmitted to the foundation. This additional thrust shall be taken into the consideration of pump design.		
9.02.00	Impeller		
9.02.01	The Impeller assembly shall be dynamically balanced and designed with critical speed substantially above the operating speed.		


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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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<p>a) 16% margin over the pump shaft input power at the rated duty point.</p> <p>b) 10% margin over the maximum pump shaft input power required within the 'Range of Operation'.</p> <p>c) Pump shaft input power required considering the overloading of the pump assuming single pump operation in the event of tripping of one or more of the pumps operating in parallel.</p>			
9.10.00	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.		
	<p>a) Identification and Testing</p> <p>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.</p> <p>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.</p> <p>iii) Tests for each pump included under this section shall include but not be limited to the following:</p>		

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<ul style="list-style-type: none"> - The entire surface of the impeller / casing / diffuser castings shall be subjected to Dye Penetration Test as per ASTM Specification no.:1-165-65. - Shaft coupling & other active components shall be subjected to Dye Penetration and Ultrasonic Tests. - Wearing rings, shaft sleeves shall be subjected to Dye Penetration Test. - Fabricated components of pumps shall be subjected to Dye Penetration test on weld. - Verification of material, witnessing of pouring, casting and inspection of finished fabricated/castings. - Inspection of finished castings for impeller and verification of materials. - Inspection of pump shaft and verification of material. - Witnessing of NDT/review of NDT reports. - Static balancing test for impeller and dynamic balancing of complete rotating parts as per ISO- 1940 to grade 6.3 or better. - Complete Inspection of assembled pump. 			
b) Hydraulic Testing			
<p>The pump casing shall be hydrostatically tested at maximum of the following:</p> <ol style="list-style-type: none"> i. 2 times the TDH (Total Dynamic Head) at rated capacity (or) ii. 1.5 times the shut-off pressure (or) iii. System Design pressure indicated in Data Sheet-A of Section-I. <p>The HT pressure shall be maintained for a period of not less than 30 minutes. During testing there should not be any pressure drop & leakage.</p>			
c) Performance Test at Shop			
<ol style="list-style-type: none"> 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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<p>head and capacity are to be achieved during testing to establish the performance curves, including the design capacity point, shut-off point and the two extremities of the range of operation as specified in the annexure. After completion of performance test, all pumps shall be stripped down for inspection of internals.</p> <p>iii) Tests shall be conducted with actual drive motors being furnished.</p> <p>iv) NPSH tests are to be conducted for each type at 3% head drop conditions, if specified in the pump approved QP.</p> <p>v) 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.</p> <p>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.</p> <p>10.03.00 Inspection of Mandatory/ Recommended spares shall be in line with approved QP for main supply.</p> <p>11.00.00 DRAWINGS/ DOCUMENTS DISTRIBUTION SCHEDULE</p> <p>11.01.00 After award of LOI, the successful bidder shall submit drawings/documents as per Data Sheet-C.</p> <p>11.02.00 The no. of drawings/documents to be submitted shall be as per Data Sheet-C.</p> <p>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.</p> <p>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.</p> <p>Within one (1) week of receipt of BHEL comments a technical representative from Bidder's works shall come for meeting with BHEL along with revised documents to resolve all issues and incorporate all comments in the soft copy here only for further submission to customer.</p> <p>Further on receipt of customer's comments on the documents a technical representative from Bidder's works shall come for meeting with Customer to resolve all issues and incorporate all comments in the soft copy here only and further resubmission of same to Customer. The representative shall be available here till Category-I approval of all the drawings and documents.</p>			

	TITLE: STANDARD TECHNICAL SPECIFICATION HORIZONTAL PUMPS	SPECIFICATION NO. PES-179-06	
		VOLUME:	
		SECTION: IIA	
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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:

- Compliance certificate duly signed and stamped (enclosed at Section-IIIB).
- 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.
- Guarantee Schedule duly signed and stamped (enclosed at Section-IIIA).
- Technical deviation schedule (if reqd.) (enclosed at Section-IIIC).
- 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.
- Unpriced copy of the price bid shall be furnished along with the technical bid.

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


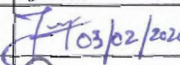
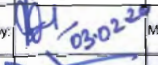
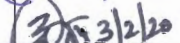
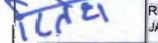
In case of any deviation from this technical specification, the same shall be indicated in the schedule of deviations as per Section-IIIC or NIT. In the absence of duly filled schedules it will be assumed that the bid strictly conforms to the specification.

	TITLE: STANDARD TECHNICAL SPECIFICATION HORIZONTAL PUMPS	SPECIFICATION NO. PES-179-06	
		VOLUME:	
		SECTION: IIA	
		REV. NO. 04	DATE: 01/07/2016
		SHEET 16 of 16	


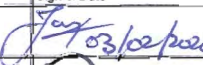
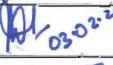


DATA SHEET – C**Drawings / documents distribution schedule to be followed by successful Bidder:**

- 1.0** Drawings/documents submission schedule, shall be as per Section-IA.
The successful bidder shall submit at least following drawings/ documents:
- 1.1** Fully dimensioned outline general arrangement drawings of the pump and motor assembly. This drawing should include foundation base plate/sole plate details as applicable, civil foundation, anchor bolt details, loading data (Static and Dynamic), points of connections of external piping, cables and mounting of devices furnished by the supplier and details for Gap between Coupling Shafts, Float & details for axial/radial tolerance allowed etc. which are required for erecting agency during erection of pump.
- 1.2** Cross sectional drawing of the equipment showing the details of assembly of components and their material of construction with standard applicable codes.
- 1.3** Technical datasheet as per Datasheet-B (Section-IIID) including characteristic curves of pumps showing the following:
- Flow Vs Head
 - Flow Vs Power
 - Flow Vs Efficiency
 - 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:
- Drawings of components & details as deemed necessary.
 - Instruction manual for erection, operation & maintenance.
 - Storage instruction.
- 3.0** Before dispatch of the equipment the bidder shall furnish the following.
- Material test certificates.
 - Shop test reports & certificates.
 - Fulfilment of packing instructions as indicated in Section-IA of this specification.
- 4.0** Distribution of drawings / documents for all projects:


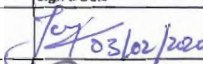
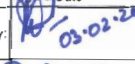
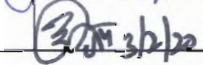
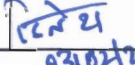
The no. of copies of drawing/ documents to be submitted by the successful bidder, after the award of the contract shall be as per Section-IA or as specified in NIT.


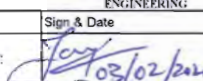
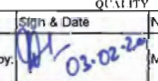

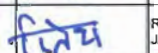
MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS				QUALITY PLAN				SPEC NO.: PE-TS-XXX-100-N001		DATE		
				CUSTOMER:				QP NO.: PE-QP-999-100-N004		DATE		
				PROJECT:				PO NO.:		DATE		
				ITEM: MISC. PUMPS (HORIZONTAL/VERTICAL)		SYSTEM: CW/ACW/DMCW/PLANT/COMMON		SECTION:		SHEET 1 OF 6		
S. No.	COMPONENT & OPERATION	CHARACTERISTIC	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY **		REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	13
					M C/N							
1	RAW MATERIALS											
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	✓	P	V	V
1.2	STUFFING BOX, SUCTION BELL, WEARING RINGS, NECK RINGS, SHAFT SLEEVES	MECHANICAL AND CHEMICAL PROPS	MA	MECHANICAL AND CHEM. ANALYSIS	ONE/HEAT/BATCH	APPROVED CS DRAWING/DATA SHEET	RELEVANT MATERIAL SPECN.	LAB REPORT/ MTC	✓	P	V	V
		HARDNESS DIFFERENCE BETWEEN CASING / IMPELLER AND WEARING RING	MA	LAB. TEST	100%	APPROVED CS DRAWING/DATA SHEET	50 BHN MIN.	LAB. REPORT	✓	P	V	V
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	✓	P	V	V
		2. DIMENSIONS	CR	2. MEASUREMENT	100%	MFR. DRAWING	MFR. DRAWING	INSP. REPORT	✓	P	V	V
		3. INTERNAL DEFECTS FOR 40MM & ABOVE DIA SHAFTS.	CR	3. ULTRA SONIC TEST	100%	ASTM A388 BACK WALL ECHO 100%	DEFECT ECHO MAX 20% OF B.W.E. LOSS OF BACK WALL ECHO 20% MAX	NDT CERTIFICATE	✓	P	V	V
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.	RELEVANT MATERIAL SPECN.	CORRELATED SR/HT. CHARTS	✓	P	V	V
		2. IGC TEST FOR SS CASTING	MA	LAB. TEST	ONE SAMPLE/ HT BATCH	ASTM A 262	ASTM A 262 Gr A	LAB. REPORT	✓	P	V	V
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./MFG./ APPROVED DOCS	MFR T.C OR LAB. REPORT	✓	P	V	V
BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL				
ENGINEERING				QUALITY				Sign & Date		Doc No:		
Sign & Date		Name		Sign & Date		Name		Sign & Date		Name		Seal
Prepared by: 		TANUJ MATTA		Checked by: 		MOHIT KUMAR		Seal		Reviewed by:		
Reviewed by: 		AJAY JAIN		Reviewed by: 		RITESH KUMAR JAISWAL		Seal		Approved by:		


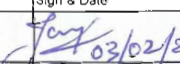
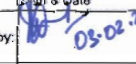
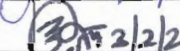

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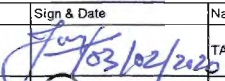
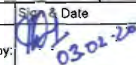
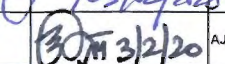
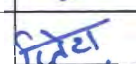
	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS			QUALITY PLAN				SPEC NO.: PE-TS-XXX-100-N001		DATE			
				CUSTOMER				QP NO.: PE-QP-999-100-N004		DATE			
				PROJECT :				PO NO.:		DATE			
				ITEM: MISC PUMPS (HORIZONTAL/VERTICAL)		SYSTEM CW/ACW/DMCW/PLANT/ COMMON		SECTION:		SHEET 2 OF 6			
S. No.	COMPONENT & OPERATION	CHARACTERISTIC	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
1	2	3	4	5	6	7	8	9	10	11	12		
					M / C/N								
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	✓	P	V	V	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	✓	P	V	V	
1.8	MECHANICAL SEAL (IF APPLICABLE)	TYPE, SIZE, MFRS, NO., MAKE	MA	VISUAL EXAM	100%	APPROVED DATASHEET / GA MECH. SEAL	APPROVED DATASHEET		✓	P	V	V	COMPLIANCE TC FOR APPROVED MAKE
1.9	PUMP BEARINGS	TYPE, SIZE, MFRS, NO., MAKE	MA	VISUAL EXAM	100%	APPROVED DATASHEET	APPROVED DATASHEET		✓	P	V	V	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	✓	P	V	V	
2.2	IMPELLER	CLEANING AND DEBURRING	MA	VISUAL	100%	MFG. DRAWING	MFG. DRAWING		✓	P	V	V	
	IMPELLER	DYNAMIC BALANCING	CR	DYNAMIC BALANCING	100%	ISO 1940	ISO 1940 Gr 6.3	BALANCING CERTIFICATE	✓	P	W	V	WTNESSING 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	✓	P	W	V	
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	✓	P	V	V	
2.5	SHAFT	DP TEST	MA	DP TEST ON M/CED AREA	100%	ASTM E 165	NO RELEVANT INDICATION ALLOWED	NDT CERTIFICATE	✓	P	W	V	
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	✓	P	W	V	HAMMERING OF CASTINGS WITH WOODEN/ RUBBER Mallet BEFORE HYDRO TEST
BHEL						BIDDER SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL					
ENGINEERING			QUALITY			Sign & Date		Doc No:		Sign & Date			Seal
Prepared by: 			Name: TANUJ MATTA			Checked by: 		Name: MOHIT KUMAR		Reviewed by:			
Reviewed by: 			Name: AJAY JAIN			Reviewed by: 		Name: RITESH KUMAR JAISWAL		Approved by:			

03/04/2020


		MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS			QUALITY PLAN				SPEC NO.: PE-TS-XXX-100-N001		DATE			
					CUSTOMER:				QP NO.: PE-QP-999-100-N001		DATE			
					PROJECT				PO NO.:		DATE			
					ITEM: MISC. PUMPS (HORIZONTAL/VERTICAL)		SYSTEM: CW/ACW/DMCW/PLANT/ COMMON		SECTION:		SHEET 3 OF 6			
S. No.	COMPONENT & OPERATION	CHARACTERISTIC	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY **				REMARKS	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	
					M	C/N								
2.7	FABRICATED COMPONENTS													
2.7.1	WELDING PROCEDURE SPECIFICATION	CORRECTNESS	MA	EXAM.	100%	ASME SEC.IX	ASME SEC.IX	QW 482 OF ASME SEC.IX	√	P	V	V	WELDING PROCEDURE APPROVAL BY BHEL, ALT. 3RD PARTY (LLYODS,BVQI OR EQ.) IS ACCEPTABLE.	
2.7.2	WELDING PROCEDURE QUALIFICATION RECORD	WELD SOUNDNESS	MA	VISUAL,PHYS. TESTS RT (AS APPLICABLE)	100%	ASME SEC.IX	ASME SEC.IX	QW 483 OF ASME SEC.IX	√	P	V	V		
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	√	P	V	V		
2.7.4	WELD FIT-UPS	DIMENSION & ALIGNMENT	MA	MEAS,VISUAL EXAM	100%	WPS, MFG . DRAWING	WPS, MFG . DRAWING	IR/LOGBOOK	√	P	V	V		
2.7.5	ROOT RUNS	SURFACE DEFECTS	MA	PENETRANT TEST	100%	ASTM E 165	NO SURFACE DEFECT	IR/LOGBOOK	√	P	V	V		
2.7.6	WELDMENTS	SURFACE DEFECTS	MA	PENETRANT TEST	100%	ASTM E 165	ASME-VIII, DIV I	INSPN REPORT	√	P	W	V	WITNESS BY BHEL & VERIFICATION BY CUSTOMER	
BHEL					BIDDER/ SUPPLIER					FOR CUSTOMER REVIEW & APPROVAL				
ENGINEERING				QUALITY				Sign & Date		Doc No:				
Sign & Date		Name		Sign & Date		Name		Sign & Date		Name		Seal		
Prepared by: 		TANUJ MATTa		Checked by: 		MOHIT KUMAR		Seal		Reviewed by:				
Reviewed by: 		AJAY JAIN		Reviewed by: 		RITESH KUMAR JAISWAL				Approved by:				

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS				QUALITY PLAN				SPEC NO.: PE-TS-XXX-100-N001		DATE			
				CUSTOMER:				QP NO.: PE-QP-999-100-N004		DATE			
				PROJECT :				PO NO :		DATE			
				ITEM: MISC. PUMPS (HORIZONTAL/VERTICAL)		SYSTEM: CW/ACW/DMCW/PLANT/ COMMON		SECTION		SHEET 4 OF 6			
S. No.	COMPONENT & OPERATION	CHARACTERISTIC	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY **		REMARKS	
1	2	3	4	5	6	7	8	9	* D	10		11	
					M / C/N					M	C	N	
2.7.7	BUTT WELDS	INTERNAL DEFECT	MA	UT/RT	100%	ASME SEC. V	ASME-VIII, DIV I	IR	✓	P	W	V	WITNESSING OF U.T
2.7.8	DICHARGE HEAD, COLUMN PIPE, DISCHARGE PIPE, ETC.	1. LEAK TIGHTNESS 2. DIMENSION	CR	1. HYDROTEST 2. MEASUREMENT	100%	APPROVED DATA SHEET/ APPROVED OP APPROVED GA- CS DRG/MFR DRG.	1. NO LEAKAGE 2. MFR. DRAWING	IR	✓	P	W	V	
3.0	SUB-ASSEMBLY CONTROL												
3.1	ROTOR ASSEMBLY	ECCENTRICITY	MA	MEASUREMENT	100%	APPROVED GA DRG/ MFR.DRAWING	APPROVED GA DRG/ MFR.DRAWING	IR/LOG BOOK	✓	P	V	V	
3.2	ROTOR ASSEMBLY RESIDUAL UNBALANCE	STATIC & DYNAMIC	CR	STATIC & DYNAMIC BALANCING	100%	ISO 1940	ISO 1940 Gr 6.3	BALANCING CERTIFICATE	✓	P	W	V	WITNESSING ONLY FOR SIZE GREATER THAN 10KW
3.3	COMPLETE PUMP ASSEMBLY	COMPLETENESS, CORRECTNESS, CLEANLINESS, CLEARANCES, FREEMESS, ALIGNMENT	MA	VISUAL EXAM MEASUREMENT	100%	APPROVED DRG & MFG STANDARDS	APPROVED DRG & MFG STANDARDS	I.R. & CHECK LISTS	✓	P	V	V	
BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL					
ENGINEERING				QUALITY		Sign & Date		Doc No:					
Sign & Date		Name		Sign & Date		Name		Sign & Date		Name		Seal	
Prepared by: 		TANUJ MATT		Checked by: 		MOHIT KUMAR		Seal		Reviewed by:			
Reviewed by: 		AJAY JAIN		Reviewed by: 		RITESH KUMAR JAISWAL				Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS			QUALITY PLAN				SPEC NO.: PE-TS-XXX-100-0001		DATE					
				CUSTOMER:				QP NO.: PE-QP-999-100-0004		DATE					
				PROJECT:				PO NO		DATE					
				ITEM: MISC. PUMPS (HORIZONTAL/VERTICAL)		SYSTEM: CW/ACW/DMCW/PLANT/ COMMON		SECTION:		SHEET 5 OF 6					
S. No.	COMPONENT & OPERATION	CHARACTERISTIC	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY ** M C N		REMARKS			
1	2	3	4	5	6	7	8	9	* D	10	11				
4	FINAL INSPECTION, TESTS & PACKING DESPATCH CONTROL														
4.1	PUMP WITH JOB/SHOP MOTOR ASSEMBLED ON INDIVIDUAL BASE FRAME	1. Q V/S HEAD, 2. Q V/S POWER, 3. Q V/S PUMP EFF. 4. VIBRATION 5. NOISE 6. BEARING TEMP. 7. LEAKAGES	CR	PERFORMANCE TEST	100%	APPD. PERFORMANCE TEST PROCEDURE/ APPD. DATA SHEET/APPD. CURVES FOR VIBRATIONS - AS PER ANSI/HIS 9.8.4-2009 (VALUES AS PER APPROVED DATA SHEET) FOR BEARING TEMP - BEARING HOUSING SHOULD NOT BE UNTOUCHABLY HOT. FOR LEAKAGE - MINOR LEAKAGE (DROP BY DROP) IN CASE OF GLAND PACKING ARRANGEMENT.		I.R., PERF. TEST RECORD, PLOTTED CURVES	✓	P	W	W	* MINIMUM 7 POINTS FROM SHUT-OFF TO MAX. OPERATING FLOW COVERING ENTIRE OPERATION RANGE OF PUMP SHALL BE TAKEN. * CUSTOMER HOLD POINT		
		NPSH REQUIRED	CR	NPSH TEST	1/MODEL	APPD. PERFORMANCE TEST PROCEDURE/ APPD. DATA SHEET/APPD. CURVES		IR. NPSH TEST RECORD, PLOTTED CURVES	✓	P	W	W	IF SPECIFIED or INSISTED BY CUSTOMER.		
4.2	STRIP DOWN AFTER PERFORMANCE TEST	1. UNDUWEAR TEAR AND RUBBING	MA	VISUAL EXAM AFTER STRIPPING	1/MODEL	NO UNDUWEAR TEAR & RUBBING ON IMPELLER & WEAR RING		INSP. REPORT	✓	P	W	W	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	✓	P	W	V			
BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL							
ENGINEERING			QUALITY			Sign & Date		Doc No:		Sign & Date			Name	Seal	
Prepared by:  03/02/2020			Name: TANUJ MATT			Checked by:  03-02-20			Name: MOHIT KUMAR			Reviewed by:			
Reviewed by:  03/02/2020			Name: AJAY JAIN			Reviewed by:  03/02/2020			Name: RITESH KUMAR JAISWAL			Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS			QUALITY PLAN				SPEC NO.: PE-TS-XXX-100-N001		DATE					
				CUSTOMER:				QP NO.: PE-QP-999-100-N004		DATE					
				PROJECT :				PO NO.		DATE					
				ITEM: MISC PUMPS (HORIZONTAL/VERTICAL)		SYSTEM: CW/ACW/DMCW/PLANT/ COMMON		SECTION:		SHEET 6 OF 6					
S. No.	COMPONENT & OPERATION	CHARACTERISTIC	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY **			REMARKS		
1	2	3	4	5	6	7	8	9	* D	10			11		
					M / C/N										
4.4	PAINTING	1. SURFACE FINISH, DFT, MARKINGS ETC.	MA	VISUAL EXAM MEASUREMENT AESTHETIC	100%	APPD.DRG.	APPD.DOCS	IR.	✓	P	V	V			
4.5	PACKING, MARKING	SOUNDNESS OF PACKING	MI	VISUAL AESTHETIC	100%	TECHNICAL SPECIFICATION/ MFG. STANDARD	TECHNICAL SPECIFICATION/ MFG. STANDARD	PHOTOGRAPHS	✓	P	V		PHOTOGRAPHS OF PACKED MATERIAL TO BE VERIFIED BY BHEL BEFORE ISSUING MOCC		
<p>NOTES:</p> <p>1. AS CAST HEAT MARKS SHALL BE PROVIDED ON CI CASTING LIKE TOP & BOTTOM CASING.</p> <p>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.</p> <p>3. THIS QAP IS ALSO APPLICABLE FOR SPARES.</p> <p>4. NO WELD REPAIRS PERMISSIBLE ON CI CASTING.</p> <p>5. MATERIAL SHALL BE AS PER APPROVED CROSS SECTION DRG./ DATA SHEET.</p> <p>6. STRIP TEST- IN CASE 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.</p> <p>7. PUMPS WITH MECHANICAL SEAL ARRANGEMENT TO BE TESTED AND SUPPLIED WITH GLAND PACKING ARRANGEMENT. HOWEVER MANUFACTURER TO ENSURE DIMENTIONAL MATCHING OF MECHANICAL SEAL WITH PUMP GA DRAWING.</p> <p>8. BHEL RESERVES THE RIGHT FOR CONDUCTING REPEAT TEST IF REQUIRED.</p> <p>9. PMI (POSITIVE MATERIAL IDENTIFICATION) INSPECTION WITNESS BY "C"/"N" FOR MATERIAL GRADE OF PUMP CASING/BOWL ASSEMBLY, SHAFT, SHAFT SLEEVE, IMPELLER AND COLUMN PIPE (FOR VERTICAL PUMPS) ON RANDOM SAMPLE BASIS. HOWEVER, VENDOR TO CONDUCT 100% PMI AND PROVIDE PMI CERTIFICATES FOR REVIEW BY "C"/"N" DURING INSPECTION AT VENDOR WORKS.</p>															
<p>LEGEND : - * RECORDS, IDENTIFIED WITH "TICK"(✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.</p> <p>** M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, C: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, N: CUSTOMER</p> <p>P- PERFORM, W- WITNESS, V- VERIFICATION, AS APPROPRIATE</p> <p>MA: MAJOR, MI: MINOR, CR: CRITICAL, MTC - Mill Test Certificate, TC- Test Certificate, IGC- Inter Granular Corrosion.</p> <p>GA - GENERAL ARRANGEMENT DRAWING, CS- CROSS-SECTIONAL DRAWING</p>															
BHEL					BIDDER/ SUPPLIER			FOR CUSTOMER REVIEW & APPROVAL							
ENGINEERING				QUALITY											
Sign & Date		Name		Sign & Date		Name		Doc No:		Sign & Date		Name		Seal	
Prepared by: 		TANUJ MATT A		Checked by: 		MOHIT KUMAR		Reviewed by:							
Reviewed by: 		AJAY JAIN		Reviewed by: 		RITESH KUMAR JAISWAL		Approved by:							

597366/2021/PS-PEM-MSE

	TITLE: TECHNICAL SPECIFICATION MISCELLANEOUS PUMPS STANDARD TECHNICAL REQUIREMENTS	SPEC. NO.: PE-TS-457/463-100-N001	
		SECTION: II	
		SUB-SECTION: IIB	
		REV. NO. 00	DATE 14.12.2021
		SHEET 1	OF 1

SUB-SECTION - IIB

STANDARD TECHNICAL SPECIFICATION (ELECTRICAL)

STANDARD QUALITY PLAN (ELECTRICAL)

597366/2021/PS-PEM-MSE



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



FILE :
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.



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.

	FILE : 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	




FILE :
GENERAL TECHNICAL REQUIREMENTS
FOR
LV MOTORS


SPECIFICATION NO.
 PE-SS-999-506-E101
 VOLUME NO. : **II-B**
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 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.

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	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :		DATE:
		CUSTOMER :		QP NO.: PE-QP-999-Q-006, REV-02		DATE: 17.04.2020
		PROJECT:		PO NO.:		DATE:
		ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))	SYSTEM:	SECTION: II		SHEET 1 of 2


S. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**		
					M	C/ N				D	M	C	N
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	-	MFG. SPEC.	MFG. SPEC.	LOG BOOK		P	-	-
		2.DIMENSIONS	MA	VISUAL	100%	-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	LOG BOOK		P	-	-
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	-	MFG.SPEC./	MFG.SPEC.	LOG BOOK		P	-	-
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	-	MFG. SPEC/ APPROVED DATASHEET	MFG. SPEC/ APPROVED DATASHEET	LOG BOOK	✓	P	V	-
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST	MA	VISUAL	100%	-	IS-325 / IS-12615/ APPROVED DATA SHEET	IS-325 / IS-12615/ APPROVED DATA SHEET	TEST/ INSPN. REPORT	✓	P	V *	-
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	-	APPROVED DRG/ DATA SHEET	APPROVED DRG/ DATA SHEET	TEST/ INSPN. REPORT	✓	P	V *	-

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	HEMA KUSHWAHA	HEMA KUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:	PRAVEEN DUTTA	PRAVEEN DUTTA	Reviewed by:	RITESH KUMAR JAISWAL	RITESH KUMAR JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

597366/2021/PS-PEM-MSE

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-Q-006, REV-02	DATE: 17.04.2020
		PROJECT:		PO NO.:	DATE:
		ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))	SYSTEM:	SECTION: II	SHEET 2 of 2

		3.NAMEPLATE DETAILS	MA	VISUAL	100%	-	IS-325 / IS-12615 / APPROVED DATA SHEET	SAME AS COL. 7	TEST/ INSPN. REPORT	✓	P	V	-	
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MFG. STANDARD / (#)	AS PER MFG. STANDARD / (#).	INSPC. REPORT	✓	P	W	-	(#) REFER NOTE-8

NOTES:

1. Routine tests on 100% motors shall be done by the vendor. However, BHEL/ Customer shall witness routine tests on random samples. The sampling plan shall be mutually agreed upon.
2. For exhaust/ventilation fan motors of rating up to 1.5 KW, only routine test certificates shall be furnished for scrutiny.
3. In case test certificates for these tests on similar type, size and design of motor from independent laboratory are available, the same is valid for 5 years.
4. BHEL reserves the right to perform repeat test, if required.
5. After packing and prior to issue MDCC, photographs of items to be despatched shall be sent to BHEL for review.
6. In case of any changes in QP commented by customer at contract stage, same shall be carried out by bidder without any implication to BHEL/ Customer.
7. Project specific QP to be developed based on customer requirement.
8. For export job, BHEL technical specification for seaworthy packing to be followed.
9. Packing shall be suitable for storage at site in tropical climate conditions.
10. Latest revision/ year of issue of all the standards (IS/ ASME/ IEC etc.) indicated in QP shall be referred.

LEGENDS:



*RECORDS, IDENTIFIED WITH "TICK"(✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,

** **M:** SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **B:** MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **C:** CUSTOMER,


P: PERFORM, **W:** WITNESS, **V:** VERIFICATION, AS APPROPRIATE

MA: MAJOR, **MI:** MINOR, **CR:** CRITICAL

D: DOCUMENTATION

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:	HEMA KUSHWAHA	HEMA KUSHWAHA	Checked by:		KUNAL GANDHI			Reviewed by:			
Reviewed by:	PRAVEEN DUTTA	PRAVEEN DUTTA	Reviewed by:		RITESH KUMAR JAISWAL			Approved by:			

597366/2021/PS-PEM-MSE

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO. :		DATE:17.04.2020
		CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:	SECTION: II	SHEET 1 OF 9


SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD	AGENCY			
1	2	3	4	5	6		7	8	9	*	**		
					M	C/N				D	M	C	N
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	P	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	LOG BOOK	P	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	SAMPLE	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	TEST REPORT	P/V	-	-	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%	-		FREE FROM CRACKS, UN-EVENNESS ETC,	TEST REPORT	P	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	TC	P/V	-	-	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%	-	MANUFACTURER'S DRG./SPEC	FREE FROM CRACKS, BLOW HOLES ETC,	LOG BOOK	P/V	-	-	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	TC	P/V	-	-	HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG.	MANUFACTURER'S DRG.	LOG BOOK	P/V	-	-	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	LOG BOOK	P/V	-	-	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	HEMA KUSHWAHA	HEMA KHUSHWAHA	Checked by:	KUNAL GANDHI	KUNAL GANDHI
Reviewed by:	PRAVEEN DUTTA	PRAVEEN DUTTA	Reviewed by:	R K JAISWAL	R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

597366/2021/PS-PEM-MSE

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO.:	DATE:17.04.2020
		CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04	
		PROJECT:		PO NO.:	
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	


SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S DRG./ STD.	TC		P/V	-		
		3. DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S DRG.	LOG BOOK		P/V	-		
		4.INTERNAL FLAWS	CR	ULTRASONIC TEST	100%	-	ASTM-A388	MANUFACTURER'S STD.	INSPECTION REPORT	✓	P/W	V	-	FOR DIA OF 55 MM & ABOVE
1.6	SPACE HEATERS, CONNECTORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	100%	-	MANUFACTURER'S DRG./STD.	MANUFACTURER'S DRG./STD.	INSPECTION REPORT		P/V	-	-	
		2. PHYSICAL COND.	MA	VISUAL	100%	-	MANUFACTURER'S DRG./STD.	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	INSPECTION REPORT		P/V	-	-	
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG./ STD	MANUFACTURER'S DRG. / STD.	INSPECTION REPORT		P/V	-	-	
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-	MANUFACTURER'S DRG./ STD	MANUFACTURER'S DRG. / STD.	TEST REPORT		P/V	-	-	

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ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	HEMA KUSHWAHA	HEMA KUSHWAHA	Checked by:	KUNAL GANDHI	KUNAL GANDHI
Reviewed by:	PRAVEEN DUTTA	PRAVEEN DUTTA	Reviewed by:	R K JAISWAL	R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO. :		DATE:17.04.2020
		CUSTOMER :		QP NO.: PE-QP-899-Q-007, REV-04		
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					M	C/N				D	M	C	N
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC.	MA	VISUAL	100%	-	-	NO VISUAL DEFECTS	TEST REPORT		P/V	-	-
		2.DIMENSION(BORE DIA, WALL THICKNESS, BDV AS RECEIVED, BDV AFTER FOLDING AT 180°	MA	TEST	SAMPLE	-	MANUFACTURER'S STD.	MANUFACTURER'S STD.	LOG BOOK AND OR SUPPLIER'S TC		P/V	-	-
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND.	MA	VISUAL	100%	-	-	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK		P	-	-
		2.DIMENSIONS INCLUDING BURS HEIGHT	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG. .	MANUFACTURER'S DRG.	LOG BOOK		P/V	-	-
		3. ACCEPTANCE TESTS	MA	ELECT. & MECH TESTS	SAMPLE	-	MANUFACTURER'S DRG./ STD.	MANUFACTURER'S DRG./ STD.	TC		P/V	-	-
1.9	CONDUCTORS	1. SURFACE FINISH	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		*P/V	-	-
		2.ELECT. PROP. & MECH. PROP	MA	ELECT. & MECH.TEST	SAMPLES	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S / SPEC.	TC & VENDOR'S TEST REPORTS		P/V	-	-

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


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1.10	BEARINGS	3.DIMENSIONS	MA	MEASUREMENT	SAMPLES	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S / SPEC.	LOG BOOK		P/V	-	-
		1.MAKE & TYPE	MA	VISUAL	100%	-	MANUFACTURER'S DRG./ APPROVED DATASHEET	MANUFACTURER'S DRG./ APPROVED DATASHEET	LOG BOOK		P/V	-	-
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	APPROVED DATASHEET	APPROVED DATASHEET/ BEARING MANUF'S CATALOGUES	LOG BOOK		P/V	-	-
		3.SURFACE FINISH	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P/V	-	-
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P	-	-
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	SAMPLE	-	MANUFACTURER'S STD./ APPROVED DATASHEET	MANUFACTURER'S STD./ APPROVED DATASHEET	LOG BOOK		P/V	-	-
		4.HV/IR	MA	-DO-	100%	-	MANUFACTURER'S STD./ APPROVED DATASHEET	MANUFACTURER'S STD./ APPROVED DATASHEET	LOG BOOK		P/V	-	-
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	-	MANUFACTURER'S DRG/SPECS	MANUFACTURER'S DRG/ SPECS.	LOG BOOK		P	-	-
		2.SURFACE COND.	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P	-	-
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-

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2.0	IN PROCESS													
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-	MANUFACTURER'S DRG	GOOD FINISH	LOG BOOK		PAW	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-	-DC-	GOOD FINISH	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	100%	-	MANUFACTURER'S STD./ASTM E165	MANUFACTURER'S STD./APPROVED DATASHEET.	LOG BOOK	✓	P	V	-	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		3.SHADE	MA	VISUAL	SAMPLE	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	SAMPLE	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	

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
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					M	C/N				D	M	C	N	
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S STD.	MANUFACTURER'S STD.	LOG BOOK		P	-	-	
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-	MANUFACTURER'S STD.	MANUFACTURER'S STD.	LOG BOOK		P	-	-	
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		2.CLEANLINESS	CR	VISUAL	100%	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		3.IR+HV-IR	CR	ELECT. TEST	100%	-	IS-325/IS-12615/IEC-60034 PART-1	IS-325/IS-12615/IEC-60034 PART-1	TEST/INSPC. REPORT	✓	P	V	-	
		4.RESISTANCE	CR	ELECT. TEST	100%	-	IS-325/IS-12615/IEC-60034 PART-1	IS-325/IS-12615/IEC-60034 PART-1	TEST/INSPC. REPORT	✓	P	V	-	
		5.INTERTURN INSULATION	CR	ELECT. TEST	100%	-	IS-325/IS-12615/IEC-60034 PART-1	IS-325/IS-12615/IEC-60034 PART-1	TEST/INSPC. REPORT		P	-	-	
2.6	IMPREGNATION	1.VISCOSITY	MA	PHY. TEST	AT STARTING	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK		P	-	-	
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK		P	-	-	
		3.NO. OF DIPS	MA	PROCESS CHECK	CONTINUOUS	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK	✓	P	V	-	THREE DIPS TO BE GIVEN

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2.7	COMPLETE STATOR ASSEMBLY	4.DURATION 1.COMPACTNESS & CLEANLINESS	MA MA	PROCESS CHECK VISUAL	CONTINUOUS 100%	- -	MANUFACTURER'S STANDARD MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD MANUFACTURER'S STANDARD	LOG BOOK LOG BOOK	✓ -	P P	V -	- -	
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS 2.SOUNDNESS	CR CR	VISUAL MALLET TEST & UT	100% 100%	- -	MANUFACTURER'S STANDARD MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD MANUFACTURER'S STANDARD	LOG BOOK TEST/INSPC. REPORT	- ✓	P P	- V	- -	
2.9	COMPLETE ROTOR ASSEMBLY	3.HV 1.RESIDUAL UNBALANCE	MA CR	ELECT. TEST DYN. BALANCE	100% 100%	- -	MANUFACTURER'S STANDARD MANUFACTURER'S SPEC./ ISO 1940	MANUFACTURER'S STANDARD MANUFACTURER'S DWG.	TEST/INSPC. REPORT LOG BOOK	✓ -	P P	V -	- -	
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	TEST/INSPC. REPORT	✓	P	V	-	
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK	-	P	-	-	
		2.WORKMANSHIP	MA	VISUAL	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK	-	P	-	-	
		3.AXIAL PLAY	MA	MEAS.	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK	✓	P	V	-	
		4.DIMENSIONS	MA	MEAS.	100%	-	MANUFACTURER'S DRG./ MANUFACTURER'S SPEC.	MANUFACTURER'S DRG./ MANUFACTURER'S SPEC.	LOG BOOK	-	P	-	-	
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK	-	P	-	-	
		6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK	✓	P	V	-	

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3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS	MA	ELECT.TEST	1/TYPE/SIZE	1/TYPE/SIZE	IS-325/IS-12615/APPROVED DATASHEET	IS-325/IS-12615/APPROVED DATASHEET	TEST REPORT	✓	P	W*	-	* NOTE - 1
		2.ROUTINE TESTS INCLUDING SPECIAL TEST	MA	ELECT.TEST	100%	-	IS-325/IS-12615/APPROVED DATASHEET	IS-325/IS-12615/APPROVED DATASHEET	TEST REPORT	✓	P	√ ⁵	-	⁵ NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	ELECT.TEST	100%	-	IS: 12075 / IEC 60034-14 & IS-12065	IS: 12075 / IEC 60034-14 & IS-12065	TEST REPORT	✓	P	√ ⁵	-	⁵ NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET &	TEST/INSPC. REPORT	✓	P	W	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	-	IEC 60034-5/IS-12615	APPROVED DATASHEET	TC	✓	P	V	-	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	ELECT. & MECH. TEST	100%	-	IS-325/IS-12615/IEC-60034 PART-1/IS: 12802	IS-325/IS-12615/IEC-60034 PART-1/IS: 12802	TC	✓	P	√ ⁵	-	⁵ NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	ELECT. & MECH. TEST	100%	-	IS-325/IS-12615/IEC-60034 PART-1	IS-325/IS-12615/IEC-60034 PART-1	TC	✓	P	√ ⁵	-	⁵ NOTE - 2
		8. NAME PLATE DETAILS	MA	VISUAL	100%	-	IS-325/IS-12615& DATA SHEET	IS-325/IS-12615 & DATA SHEET	TEST/INSPC. REPORT	✓	P	√ ⁵	-	⁵ NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	-	IS 2148 / IEC 60079-1	IS 2148 / IEC 60079-1	TC	✓	P	V	-	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	SAMPLE	APPROVED DATASHEET	APPROVED DATASHEET	TC	✓	P	W\$	-	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY ⁵ NOTE - 2

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
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1	2	3	4	5	6		7	8	9	*	**		
					M	C/N				D	M	C	N
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MANUFACT. STANDARD / (#)	AS PER MANUFACT. STANDARD / (#)	INSPC. REPORT	✓	P	W	-
											(#): REFER NOTE-8		

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/CUSTOMER 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, THE SAME IS VALID FOR 5 YEARS.
- 4 BHEL RESERVES THE RIGHT TO PERFORM REPEAT TEST, IF REQUIRED.
- 5 AFTER PACKING AND PRIOR TO ISSUE MDCC, PHOTOGRAPHS OF ITEMS TO BE DESPATCHED SHALL BE SENT TO BHEL PURCHASE GROUP FOR REVIEW.
- 6 IN CASE , ANY CHANGES IN QP COMMENTED BY CUSTOMER AT CONTRACT STAGE SHALL BE CARRIED OUT BY BIDDER WITHOUT ANY IMPLICATION TO BHEL/ CUSTOMER.
- 7 PROJECT SPECIFIC QP TO BE DEVELOPED BASED ON CUSTOMER REQUIREMENT.
- 8 FOR EXPORT JOB, BHEL TECHNICAL SPECIFICATION FOR SEAWORTHY PACKING TO BE FOLLOWED.
- 9 PACKING SHALL BE SUITABLE FOR STORAGE AT SITE IN TROPICAL CLIMATE CONDITIONS.
- 10 LATEST REVISION/ YEAR OF ISSUE OF ALL THE STANDARDS (IS/ ASME/ IEC ETC.) INDICATED IN QP SHALL BE REFERRED.

LEGENDS:

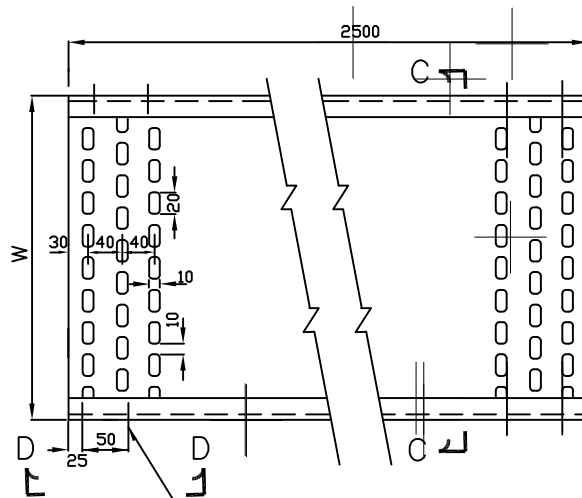
*RECORDS, IDENTIFIED WITH "TICK"(✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
 ** M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, B: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, C: CUSTOMER,
 P: PERFORM, W: WITNESS, V: VERIFICATION, AS APPROPRIATE
 MA: MAJOR, MI: MINOR, CR: CRITICAL
 D: DOCUMENT

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	HEMA KUSHWAHA	HEMA KUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:	PRAVEEN DUTTA	PRAVEEN DUTTA	Reviewed by:	RITESH KUMAR	R K JAISWAL

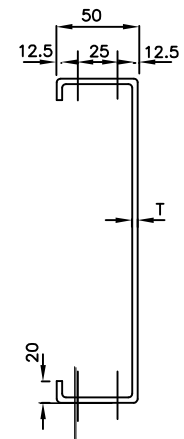
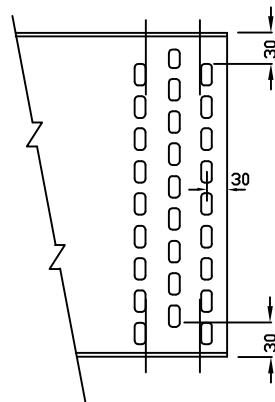
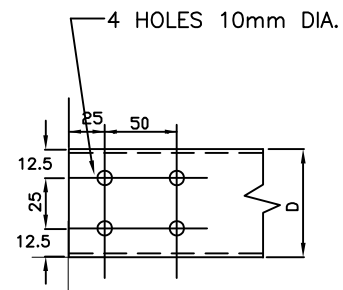
BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

597366/2021/PS-PEM-MSE



4 HOLES 10mm DIA.

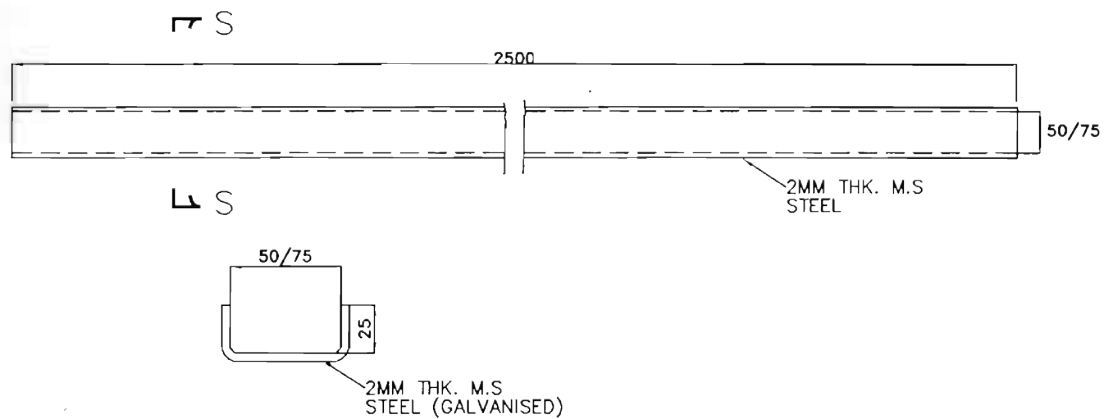
SECTION-CC
(100/50 TRAYS)ARRANGEMENT OF
PERFORATIONSVIEW-DD
(100,50W TRAYS)

TRAY WIDTH W (mm)	100	50
TRAY DEPTH D (mm)	50	50
T (mm)	2	2

PERFORATED TYPE TRAYTYPICAL DETAILS OF CABLE TRAYS AND
ACCESSORIES

DWG. NO.

597366/2021/PS-PEM-MSE



SECTION S-S

CABLE TROUGHS

SEE GENERAL NOTES IN SHEET 11.




TYPICAL DETAILS OF
CABLE TRAY AND ACCESSORIES

BHEL DRAWING NO.
PE-DG-427-507-E005

SH 10 OF 11

REV 00


597366/2021/PS-PEM-MSE

	TITLE: TECHNICAL SPECIFICATION MISCELLANEOUS PUMPS STANDARD TECHNICAL REQUIREMENTS	SPEC. NO.: PE-TS-457/463-100-N001
		SECTION: III
		SUB-SECTION:
		REV. NO. 00 DATE 14.12.2021
		SHEET 1 OF 1

SECTION III

DOCUMENTS TO BE SUBMITTED BY BIDDER

597366/2021/PS-PEM-MSE

	TITLE: TECHNICAL SPECIFICATION MISCELLANEOUS PUMPS STANDARD TECHNICAL REQUIREMENTS	SPEC. NO.: PE-TS-457/463-100-N001	
		SECTION: IIIA	
		SUB-SECTION:	
		REV. NO. 00	DATE 14.12.2021
		SHEET 1	OF 1

SECTION IIIA

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



SCHEDULE OF PERFORMANCE GUARANTEES
NPGCPL 3X660 MW NABINAGAR -FGD PROJECT

SPECIFICATION NO.: PE-TS-457/463-100-N001, Rev-00

VOLUME: -- SECTION: IIIA Sheet 1 of 1

REV. NO. 00 DATE: 14.12.2021

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	Motor Rating	Motor GD ² Value for HT motor only	Pump RPM	T/S Curve attached for HT motor
		(M3/Hr)	(MWC)	%	%	(KW)	(KW)			
	Horizontal pumps									
1	#ECW(DMCW) PUMPS	125	70					NA		NA
2	#ACW PUMPS	160	40					NA		NA

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 and clause 1.8 of Section IA 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

BRBCL 4X250 MW NABINAGAR TPP -FGD PROJECT

SPECIFICATION NO.:

VOLUME:

REV. NO.

PE-TS-457/463-100-N001, Rev-00

--

00

SECTION:

DATE:

IIIA

14.12.2021

Sheet 1 of 1

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	Motor Rating	Motor GD ² Value for HT motor only	Pump RPM	T/S Curve attached for HT motor
		(M3/Hr)	(MWC)	%	%	(KW)	(KW)			
	Horizontal pumps									
1	#ECW(DMCW) PUMPS	47	70					NA		NA
2	#ACW PUMPS	65	35					NA		NA

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 and clause 1.8 of Section IA 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
------	-------------	-----------	------	--------------

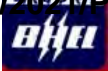
597366/2021/PS-PEM-MSE

	TITLE: TECHNICAL SPECIFICATION MISCELLANEOUS PUMPS	SPEC. NO.: PE-TS-457/463-100-N001	
		SECTION: IIIB	
		SUB-SECTION:	
		REV. NO. 00	DATE 14.12.2021
		SHEET 1	OF 1

STANDARD TECHNICAL REQUIREMENTS**SECTION IIIB**

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

597366/2021/PS-PEM-MSE

	TECHNICAL SPECIFICATIONS MISCELLANEOUS PUMPS	SPECIFICATION NO.:	PE-TS-457/463-100-N001, Rev.0		
	NPGCPL 3X660 MW NABINAGAR -FGD PROJECT BRBCL 4X250 MW NABINAGAR -FGD PROJECT	VOLUME:	--	SECTION:	IIIB
	COMPLIANCE CERTIFICATE	REV. NO.	0	DATE:	14.12.2021

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

- 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.
- 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.
- All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/ CONSULTANT/ CUSTOMER approval.
- There are no other deviation with respect to specification other than those furnished in the 'Schedule of Deviations'.
- 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.
- 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.
- Prices for recommended spares (if any) for 3 years operation shall be furnished separately & not included in the base price.
- 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).
- All sub vendors shall be as per BHEL/CONSULTANT/CUSTOMER approved list.
- 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.
- Any special tools & tackles, if required, shall be in bidder's scope.
- 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.
- 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

597366/2021/PS-PEM-MSE


	TITLE: TECHNICAL SPECIFICATION MISCELLANEOUS PUMPS STANDARD TECHNICAL REQUIREMENTS	SPEC. NO.: PE-TS-457/463-100-N001	
		SECTION: IIIC	
		SUB-SECTION:	
		REV. NO. 00	DATE 14.12.2021
		SHEET 1	OF 1

SECTION IIIC

DEVIATION SCHEDULE

(TO BE SUBMITTED ALONG WITH THE BID BY ALL BIDDERS AS PER NIT
FORMAT)

597366/2021/PS-PEM-MSE

	TITLE: TECHNICAL SPECIFICATION MISCELLANEOUS PUMPS STANDARD TECHNICAL REQUIREMENTS	SPEC. NO.: PE-TS-457/463-100-N001	
		SECTION: IIID	
		SUB-SECTION:	
		REV. NO. 00	DATE 14.12.2021
		SHEET 1	OF 1

SECTION IIID

DATA SHEET – B FOR PUMPS

ELECTRICAL LOAD DATA (FORMAT ATTACHED)

CABLE SCHEDULE (FORMAT ATTACHED)

MOTOR DATASHEET

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


597366/2021/PS-DEW-MSE

PROJECT:			
MISCELLANEOUS PUMPS			
DATASHEET - B			
SL.	DESCRIPTION	UOM	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		

597366/2021/PS-DEW-MSE

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

597366/2021/PS-DE/MSE

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

[illegible]

CABLE SCHEDULE FORMAT

ANNEXURE III

[illegible]

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

1. For the purpose of clarity, it may please be noted that the information given in regard to the cables to be routed through WinPath as per the system elaborated below is called "Cable List", while the term "Cable Schedule" applies to the cable list with routing information added after routing has been carried out.
2. The cable list shall be entered as an MS Excel file in the format as per enclosed template EXT_CAB_SCH_FORMAT.XLS. No blank lines, special characters, header, footer, lines, etc. shall be introduced in the file. No changes shall be made in the title line (first line) of the template.
3. The field properties shall be as under:
 - a. UNITCABLENO: A/N, up to sixteen (16) characters; each cable shall have its own unique, unduplicated cable number. In case this rule is violated, the cable cannot be taken up for routing.
 - b. FROM: A/N, up to sixty (60) characters; the "From" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - c. TO: A/N, up to sixty (60) characters; the "To" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - d. PURPOSE: A/N, up to sixty (60) characters; the purpose (i.e. power cable/ indication/ measurement, etc.) to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - e. REMARKS: A/N, up to forty (40) characters; Any information pertinent to routing to be specified here (e.g., cable number of the cable redundant to the cable number being entered). Information in excess of 40 characters will be truncated after 40 characters.
 - f. CABLESIZE: A/N, 7 characters exactly as per the codes indicated below shall be specified here. The program cannot route cables described in any other way/ format.
 - g. PATHCABLENO: Field reserved for utilization by the program. User shall not enter any information here.
4. One list shall be prepared for each system/ equipment (i.e., separate and unique cable lists shall be prepared for each system).
5. The cables shall be described as per the scheme listed below:

A	NN	A	NNN
Cable	No. of cores	Cable code	Cable size
Voltage	(e.g. 01,03,3H, 07)	(See C below)	(e.g. 035,185,2.5, 0.5)
Code (see B below)			

(A) SYSTEM VOLTAGE CODES:

(ac) A = 11KV, B = 6.6KV, C = 3.3KV, D = 415V, E = 240V, F = 110V

(dc) G = 220V, H = 110V, J = 48V, K = +24V, L = -24V

(B) CABLE VOLTAGE CODES:

A = 11KV (Power cables)

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

B = 6.6KV (Power cables)
 C = 3.3KV (Power cables)
 D = 1.1KV (LV & DC system power & control cables)
 E = 0.6KV (0.5 sq. mm. Control cables)

(C) CABLE CODES

PVC Copper

A = Armoured FRLS	B = Armoured Non-FRLS
C = unarmoured FRLS	D = Unarmoured Non-FRLS

PVC Aluminium

E = Armoured FRLS	F = Armoured Non-FRLS
G = unarmoured FRLS	H = Unarmoured Non-FRLS

XLPE Copper


J = Armoured FRLS	K = Armoured Non-FRLS
L = unarmoured FRLS	M = Unarmoured Non-FRLS

XLPE Aluminium

N = Armoured FRLS	P = Armoured Non-FRLS
Q = unarmoured FRLS	R = Unarmoured Non-FRLS

S = FIRE SURVIVAL CABLES
 T = TOUGH RUBBER SHEATH
 U = OVERALL SCREENED
 V = PAIRED OVERALL SCREENED
 W = PAIRED INDIVIDUAL SCREENED
 Y = COMPENSATING CABLES
 I = PRE-FABRICATED CABLES
 Z = JELLY FILLED CABLES


597366/2021/PS-PEM-MSE

	TITLE	SPECIFICATION NO.
	MOTORS	
	DATA SHEET – C	VOLUME II B
	4 x 250MW NABINAGAR FGD 3 X 660MW NABINAGAR-I FGD	SECTION D
		REV NO. 00 DATE 04.10.21
	SHEET 1 OF 2	

S. No.	Description	Data to be filled by successful bidder
A.	General	
1	Manufacturer & country of origin	
2	Motor type	
3	Type of starting	
4	Name of the equipment driven by motor & Quantity	
5	Maximum Power requirement of driven equipment	
6	Rated speed of Driven Equipment	
7	Design ambient temperature	
B.	Design and Performance Data	
1	Frame size & type designation	
2	Type of duty	
3	Rated Voltage	
4	Permissible variation for	
5	a Voltage	
6	b Frequency	
7	c) Combined voltage & frequency	
8	Rated output at design ambient temp (by resistance method)	
9	Synchronous speed & Rated slip	
10	Minimum permissible starting voltage	
11	Starting time in sec with mechanism coupled	
12	a) At rated voltage	
13	b) At min starting voltage	
14	Locked rotor current as percentage of FLC (including IS tolerance)	
15	Torque	
	a) Starting	
	b) Maximum	
16	Permissible temp rise at rated output over ambient temp & method	
17	Noise level at 1.0 m (dB)	
18	Amplitude of vibration	
19	Efficiency & P.F. at rated voltage & frequency	
	a) At 100% load	
	c) At 75% load	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

597366/2021/PS-PEM-MSE

	TITLE MOTORS DATA SHEET – C 4 x 250MW NABINAGAR FGD 3 X 660MW NABINAGAR-I FGD	SPECIFICATION NO.
		VOLUME II B
		SECTION D
		REV NO. 00 DATE 04.10.21
		SHEET 2 OF 2

S. No.	Description	Data to be filled by successful bidder
	c) At starting	
C.	Constructional Features	
1	Method of connection of motor driven equipment	
2	Applicable Standard	
3	DOP of Enclosure	
4	Method of cooling	
5	Class of insulation	
6	Main terminal box	
	a) Type	
	b) Power Cable details (Conductor, size, armour/unarmour)	
	c) Cable Gland & lugs details (Size, type & material)	
	d) Permissible Fault level (kArms & duration in sec)	
7	Space heater details (Voltage & watts)	
8	Flame proof motor details (if applicable)	
	a) Enclosure	
	b) suitability for hazardous area	
	i Zone	O / I / II
	ii Group	IIA / IIB / IIC
9	No. of Stator winding	
10	Winding connection	
11	Kind of rotor winding	
12	Kind of bearings	
13	Direction of rotation when viewed from NDE	
14	Paint Shade & type	
15	Net weight of motor	
16	Outline mounting drawing No (To be enclosed as annexure)	
D.	Characteristic curves/ drawings (To be enclosed for motors of rating $\geq 55\text{KW}$)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			