NTPC LTD

2X660 MW TALCHER TPP

TECHNICAL SPECIFICATION
FOR
MISCELLANEOUS PUMPS
(HORIZONTAL & VERTICAL)

Specification No. : PE-TS-497-100-W001 (REV. 0)

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

INDEX

THIS TECHNICAL SPECIFICATION CONSISTS OF FOLLOWING SECTIONS:

CONTENTS

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.

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

SUB-SECTION – IA

SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)

1.0 SCOPE

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

A. **2X660 MW NTPC TALCHER TPP**

1.2 The miscellaneous pumps covered under this specification shall be grouped under various group as under:
A. Horizontal Pumps
B. Vertical Pumps

NOTE:-

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

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

1.3 The miscellaneous pumps and drives covered under this specification 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-1 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 Pumps and Vertical 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 scope split given in of Section-IB of this specification.

LT drives shall be energy efficient as per subsequent clauses mentioned elsewhere in the specification. However whereever IE2 compliant motors are applicable same shall be provided with IE3 compliance only.

1.7 <u>DELIVERY & Documentation schedule:</u>

Delivery & Documentation 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 Specific requirements for Horizontal Pumps shall be as per end customer's specification attached as Annexure-2 of this section.

2.2 For Horizontal Pumps, 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 Pump bearing capacity selection and pump design.

2.4 For HT Motor driven Horizontal Pumps, RTD shall be provided for Pump Bearing Temperature Measurement.

3.0 <u>Vertical Pumps:</u>

3.1 Specific requirements for Vertical pumps shall be as per end customer's specification attached as Annexure-2 of this section.

3.2 All Vertical pump motors shall be designed/capable of withstanding max. run away speed during reverse flow. The pump shall be provided with an approved mechanical device to protect reverse rotation on loss of drive motor power and failure of discharge valve to close.
A reverse rotation detection switch shall be provided to prevent starting of motor while rotating in reverse direction.

3.3 Forced water lubrication system is applicable for Raw Water (PT) Pumps and Raw Water (Ash) Pumps. The O/H tank in RCC construction (located at the roof of Control Room, Refer attached Mech. GA of Raw Water Pump House) along with its level measuring instruments for forced water lubrication system shall be provided by BHEL. Bidder to provide set of Lubrication Pumps, Strainers, valves and instruments as per attached P&ID of Plant Water System.

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

4.0 Performance and Gaurantee Testing:

(a) Capacity, head, and power consumption of all the pumps at the rated duty point (to be demonstrated and proved at shop with the respective job motors) and to operate in accordance with the approved pump characteristic curves. During the shop test no negative tolerance in the guaranteed capacity, head and efficiency of the pump shall be allowed.

(b) Current, Voltage, Motor input Power, Frequency, Speed, Bearing/ Motor winding Temperature, Vibration and noise level of pumps and drives and parallel operation (as applicable) without hunting & abnormal noise and with load sharing within 10% of each other at the rated duty point of pumps shall be demonstrated at site as a part of Performance & Guarantee test.

Test values 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.

5.0 <u>Additional Dispatch Requirements:</u>

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

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

6.0 <u>Drawing/Document MDL:</u>

PACKAGE	BHEL DRG NO	DRG TITLE
MISC. PUMPS (HORIZONTAL)	PE-V7-497-100-W001	TDS AND PERFORMACE CURVES- MISC. PUMPS
	PE-V7-497-100-W002	GENERAL ARRANGEMENT AND CROSS SECTIONAL-PUMPS
	PE-V7-497-100-W003	TDS AND CURVES OF MOTORS FOR MISC. PUMPS
	PE-V7-497-100-W004	QP-MISC PUMPS
	PE-V7-497-100-W005	QP- MOTORS
	PE-V7-497-100-W006	MOTOR TYPE TEST DOC (if applicable)
	PE-V7-497-100-W007	O& M MANUAL -HOR. PUMPS
	PE-V7-497-100-W008	PG TEST PROCEDURE -HOR. PUMPS
MISC. PUMPS (VERTICAL)	PE-V6-497-100-W001	TDS AND PERFORMACE CURVES- MISC. PUMPS
	PE-V6-497-100-W002	GENERAL ARRANGEMENT AND CROSS SECTIONAL-PUMPS
	PE-V6-497-100-W003	TDS AND CURVES OF MOTORS FOR MISC. PUMPS
	PE-V6-497-100-W004	QP-MISC PUMPS
	PE-V6-497-100-W005	QP- MOTORS
	PE-V6-497-100-W006	MOTOR TYPE TEST DOC (if applicable)
	PE-V6-497-100-W007	O& M MANUAL -VER. PUMPS
	PE-V6-497-100-W008	PG TEST PROCEDURE -VER. PUMPS

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

7.0 BIDDER TO COMPLY FOLLOWING AFTER PLACEMENT OF PO :

1. 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.

2. Supplier to ensure that all items which will find separate mention in the packing list are covered in this detailed BOM.

3. Supplier to also give the 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 item(s)/package will be supplied free of cost in most reasonable time. "

Annexure-1

List of Miscellaneous Pumps and drives for :

A. 2X660 MW NTPC TALCHER TPP

Sl. No.	Pump Description	Total Qty.	Type of Pumps
	Vertical Pumps		
1	Raw Water (PT) Pumps	3 nos.	Vertical
2	Raw Water (Ash) Pumps	3 nos.	Vertical
	Horizontal Pumps		
1	DMCW Pumps for TG Aux's	6 nos.	Horizontal
2	DMCW Pumps for SG Aux's	4 nos.	Horizontal
3	ACW Pumps	6 nos.	Horizontal
4	CW make-up Pumps	3 nos.	Horizontal
5	HVAC make-up Pumps	2 nos.	Horizontal
6	Gypsum Wash Pumps	2 nos.	Horizontal
7	Service Water Pumps	3 nos.	Horizontal
8	APH Wash Water Pumps	2 nos.	Horizontal
9	DM Make-up Pumps	3 nos.	Horizontal
10	Condensate Transfer Pumps	2 nos.	Horizontal
11	Boiler Fill Pumps	2 nos.	Horizontal

Following HT drives for 2X660 MW TALCHER TPP, irrespective of Motor ratings shall be issue free, by BHEL:

(a) Vertical Pumps:

NIL

(b) Horizontal Pumps:

1. DMCW Pumps for SG Aux's
2. APH Wash Water Pumps

Annexure-2

HORIZONTAL CENTRIFUGAL PUMPS

1.00.00 SCOPE

General requirements in respect of design, material, constructional features, manufacture, inspection, testing the performance at the Vendor's/ Sub-Vendor's works and delivery to site erection, field testing and commissioning of Horizontal Centrifugal Pumps. The minimum technical requirements and equipment shall include, but not be limited to the following:

2.00.00 CODES AND STANDARDS

2.01.00 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. 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.

2.02.00 **List of Applicable Standards**

i) IS : 1520 - Horizontal Centrifugal Pumps for clear cold fresh water.

ii) IS : 5120 - Technical requirements of roto-dynamic special purpose pumps

iii) API - 610 - Centrifugal pumps for general refinery service.

iv) IS : 5639 - Pumps Handling Chemicals & corrosion liquids.

v) IS : 5659 - Pumps for process water

vi) HIS - Hydraulic Institute Standards; USA

vii) ASTM-I-165-65 - Standards Methods for Liquid Penetration Inspection.

3.00.00 DESIGN REQUIREMENTS

3.01.00 The maximum efficiency of pumps shall be preferably within + 10% of the rated design flow indicated in data sheets.

3.02.00 Total head capacity curve shall be continuously rising from the operating point towards shut - off without any zone of instability and with a minimum shut off head of 15% more than design head.

3.03.00 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.

3.04.00 Pumps shall run smoothly without undue noise and vibration. Peak to peak vibration limits shall be restricted to the following values during operation.

Speed	Antifriction bearing	Sleeve bearing
1500 rpm and below	75.0-micron	75.0 micron
3000 rpm	50.0-micron	65.0 micron

The noise level shall not exceed 85 dBA. Overall sound pressure level reference 0.0002 microbar (the standard pressure reference for air sound measurement) at a distance of 1M from the equipment surface.

4.00.00 DESIGN CONSTRUCTION

4.02.00 Pump casing shall have radially/axially split type construction. The casing shall be designed to withstand the maximum shut - off pressure developed by the pump at the pumping temperature. The pumps shall be capable of starting with discharge valve fully open and close condition.

CLAUSE NO.	TECHNICAL REQUIREMENTS
4.03.00	Pump casing shall be provided with a vent connection and piping with fittings & valves Casing drain as required shall be provided complete with drain valves, piping and plugs. It shall be provided with a connection for suction and discharge pr. Gauge as standard feature.
4.04.00	**Impeller** Impeller shall be closed or semi-closed as specified elsewhere and designed in conformance with the detailed analysis of the liquid being handled
4.05.00	**Impeller/ Casing Wearing Rings** Replaceable type wearing rings shall be provided at suitable locations pumps.
4.06.00	**Shaft** The critical speed shall be well away from the operating speed and in no case less than 130% of the rated speed.
4.07.00	**Shaft Sleeves** Shaft sleeves shall be fastened to the shaft to prevent any leakage or loosening
4.08.00	**Bearings** The bearings offered shall be capable of taking both the radial and axial thrust. Anti-friction bearings of standard type, if provided, shall be selected for a minimum life 16,000 hours of continuous operation at maximum axial and a radial loads and rated speed. Bearings shall be easily accessible without disturbing the pump assembly.
4.09.00	**Stuffing Boxes / Mechanical Seals** Stuffing boxes of packed ring construction type or mechanical seals shall be provided wherever specified. Packed ring stuffing boxes shall be properly lubricated and sealed as per service requirements. If external gland sealing is required, it shall be done from the pump discharge. The Mech sealing face should be low frictional co-efficient & resistance to corrosion against the liquid being pumped.
4.11.00	**Pump Shaft Motor Shaft Coupling** The Pump and motor shaft shall be connected with a adequately sized flexible coupling of proven design with a spacer
4.12.00	**Base Plate** A common base plate mounting both for the pump and motor shall be furnished. The base plate shall be of fabricated steel and of rigid construction, suitable ribbed and reinforced.
4.13.00	**Assembly and Dismantling** Assembly and dismantling of each pump with drive motor shall be possible without disturbing the grouting base plate or alignment.
4.14.00	**Drive Motor (Prime Mover)** The KW rating of the drive shall be based on continuously driving the connected equipment for the conditions specified. In case, where parallel operation of the pumps is specified, the actual motor rating is to be selected considering overloading of the pump in the event of tripping of operating pumps. Continuous motor rating (at 50 deg. Cent, ambient) for pump shall be at least 10% above the maximum load demand of the driven equipment in the complete range.

Annexure-2

VERTICAL PUMPS

1.00.00 SCOPE

1.01.00 This specification covers general requirements in respect of design, construction features, manufacture, inspection, and performance at Vendor's / sub-vendor's works delivery to site, erection field testing and commissioning of Makeup Water & Raw Water Pumps. The minimum technical requirements and equipment shall include, but not be limited to the following:

2.00.00 CODES AND STANDARDS

2.01.00 The design, material, construction, manufacture, inspection, testing and performance of Vertical Pumps shall comply with all currently applicable statutes, regulations, and safety codes in the locality where the equipment will be installed. The equipment supplied shall comply with the latest applicable Standards listed below. Other national standards are acceptable, if they are established to be equal or superior to the listed standards.

2.02.00 **List of Applicable Standards**

IS: 1710 : Vertical Turbine Pumps for clear cold fresh water.

IS: 5120 : Technical requirement of rotor dynamic special purpose pumps.

HIS : Hydraulic Institute Standards U.S.A.

PTC 82 : Centrifugal pumps-power test code

API 610: Centrifugal pumps for general refinery purposes.

3.00.00 DESIGN AND PERFORMANCE REQUIREMENTS

3.01.00 The maximum efficiency point of the pumps shall preferably lie within 10% of the rated design flow.

3.02.00 Pumps of a particular category shall be identical, suitable for parallel operation and provided with interchangeable components. Head vs. capacity and BHP vs. Capacity characteristic should match to ensure even load sharing and trouble-free operation throughout the range.

3.03.00 The pumps shall have stable Head vs. Capacity characteristic continuously rising towards shut-off with the highest at shut-off and with an approximate shut-off head of 15% or more than the design head for radial flow pumps and 50% more than the design head for mixed flow/ turbine type pumps.

3.04.00 The operating range of operation of pumps shall generally be 40% to 120% of rated flow for sustained period of operation.

3.05.00 The power requirement of the pump shall be non-over loading type for mixed flow/ turbine type pumps.

3.06.00 The critical speed of the pump shall be less than 80% of the rated speed or more than 130% of the rated speed. Also, the critical speed of the pump-motor assembly shall be more than the maximum reverse run-away speed.

3.07.00 Pump shall run smoothly without undue noise and vibration. The vibration limit measured at motor end shall not exceed the limit specified in Hydraulic Institute Standards. 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 1M from the equipment surface.

3.08.00 The base plate, foundation bolts, motor stool and other components shall be designed to take the full force coming on the discharge elbow under shut-off condition.

3.09.00 Water for motor cooling and thrust bearing cooling, if required, shall be tapped from the discharge of the pumps and/or fed from an over-head tank. All piping, valves, strainer,

instruments etc. required for this purpose and line shaft bearing lubrication (if required) shall be provided by the Contractor.

3.12.00 Reverse Rotation

a) The pump shall be provided with an approved mechanical device to protect reverse rotation on loss of drive motor power and failure of discharge valve to close.

b) a reverse rotation detection switch shall be provided to prevent starting of motor while rotating in reverse direction.

3.13.00 Motor Rating

The pumps shall be capable of starting with discharge valve fully closed as well as fully open conditions. Motors shall be selected to suit to the above requirements. Continuous motor rating (at $50^{O}C$ ambient) for all pumps shall be at least ten per cent (10%) above the maximum load demand of the driven equipment in the complete operating range (including run out condition) to take care of the system frequency/voltage variation.

Drive motors shall be connected directly to the line shaft of the pump.

4.00.00 DESIGN AND CONSTRUCTION

4.01.00 **Pump Type**

Pumps shall be of vertical shaft, single stage/multi-stage, submerged suction, complete with bowl, column & head assembly, and drive assembly. The pump design shall be of pullout/non-pull-out type as specified

4.02.00 **Discharge head**

The pump discharge shall be of above-floor type/sub- floor type. In certain cases of pump installation where expansion joint is located immediately at the pump discharge, the pump assembly will be subjected to the unbalanced hydraulic thrust. A thrust pad will be built in with the discharge head for transmitting the hydraulic thrust to external structures such that this hydraulic thrust is not transmitted to the foundation bolts for which they may not be designed.

4.03.00 **Column Pipe**

Column pipes shall be flanged and bolted and shall be complete with gaskets, nuts, and bolts.

4.04.00 **Impeller**

The impeller shall be closed, or semi-open or open as specified elsewhere.

4.05.00 **Wearing Rings**

Replaceable type wearing rings shall be provided for both casing and the impeller. For open impellers replaceable casing liners shall also be provided. The difference in hardness of the casing & impeller wearing rings shall be minimum 50 BHN.

4.06.00 **Impeller & Line Shaft**

Shaft size selected based on maximum combined shear stress must take into consideration the critical speed as per API - 610.

4.07.00 **Pump & Shaft Bearings - lubrication**

4.07.01 Adequate number of properly designed bearings shall be furnished. The type of lubrication i.e., self-water lubrication or forced water lubrication shall be provided.

4.07.02 **Self water Lubrication System**

The line shaft bearings shall be lubricated by the water being pumped. The main pump and line shaft bearings which are above minimum water level shall be of 'Thordon' type/

equivalent. For other line shaft bearings located below minimum water level, cutless rubber bearings can be used.

4.07.03 **Forced water lubrication system**

The line shaft shall be provided with shaft enclosing tube to exclude pumped water from shaft and bearings.

Lubricating water pumps shall be provided to supply lubricating water for bearings. These lubricating water pumps shall get supply from the overhead water storage tank.

4.08.00 **Thrust Bearings**

Single thrust bearing at motor top or separate thrust bearings at pump and motor shall be provided to take care of hydraulic thrust and weight of the rotating assembly. Thrust bearing shall be spherical roller type or superior, capable of absorbing axial thrust in both directions of rotation. Water required for cooling of thrust bearing shall be taken from pump discharge, wherever applicable.

The thrust bearing shall be rated for continuous operation with thrust as developed in shut-off condition with clearance between the wearing rings in worn out condition to be at least four (4) times the clearance between the wearing rings in new condition.

4.09.00 **Pump Motor Supports, Base plate etc.**

The pump and motor shall have a common support. The necessary supporting frame, base plates, mounting plates etc. as required shall be supplied under this specification.

4.10.00 **Stuffing Box**

Gland packing shall be provided at the top-of-the-line shaft. Shaft sleeves shall be provided at the stuffing box.

4.11.00 **Assembly and Dismantling**

Assembly and dismantling of each pump with drive motor shall be possible without disturbing the grouted base/sole plate or alignment.

D:\19961 DHARMENDRA KUMAR SINGH 159GB\D Drive\CONTRACT\2x660 MW Talcher TPS – 497\P&ID\Plant Water System P&ID Rev–01

फर्स्ट एंगल प्रोजेक्शन/FIRST ANGLE PROJECTION

सभी माप मि मी मे है/ALL DIMENSIONS ARE IN MM


RAW WATER RESERVOIR
MAKE UP WATER PIPE FROM STAGE–II
MAKE UP WATER PIPE FROM STAGE–II
MAKE UP WATER PIPE FROM STAGE–III
MAKE UP WATER PIPE FROM STAGE–III
NTPC
BHEL
TP: APPROX 1005.00E/4648.97N
PW01
700NB
PW77
700NB
700NB
TP: 8M FROM PLANT BOUNDARY
900NB
PW02
PW03
1200NB
PW04
PW05
GAA00 CL011
3X50% RAW WATER (ASH) PUMPS
CAP: 1165 CUM/HR
3X50% RAW WATER (PT) PUMPS
CAP: 1985 CUM/HR
RWP (ASH)-C
RWP (ASH)-B
RWP (ASH)-A
RWP (PT)-C
RWP (PT)-B
RWP (PT)-A
PUMP VENDOR
Adv–Pump Start Permissive
L–Alarm
VL–Trip pump
GAA13CF201
GAA13AP001
GAA13AA211
GAA12CF201
GAA12AP001
GAA12AA211
GAA11CF201
GAA11AP001
GAA11AA211
GAA03CF201
GAA03AP001
GAA03AA211
GAA02CF201
GAA02 AP001
GAA02AA211
GAA01CF201
GAA01 AP001
GAA01AA211
PW22
PW21
PW24
PW23
PW26
PW25
PW28
PW27
PW30
PW29
PW32
PW31
PW06
PW07
PW08
PW13
PW14
PW15
450NB
600NB
PW09
PW10
PW11
PW16
PW17
PW18
L & H
250NB
300NB
600NB
900NB
GAA20 AA001
PW12
OP–51
GAA10AA001
PW19
OP–52
GAA07CF511
GAA17CF511
2x100 % Basket strainers
2x100 % LUBRICATING WATER PUMPS
GAA05CP511
GAA04CP011
GAA05AP001
GAA06CP511
GAA06AP001
GAA07CP011
GAA07CP012
GAA14CP001
GAA15CP511
GAA15AP001
GAA16AP001
GAA16CP511
GAA17CP011
GAA17CP012
PUMP VENDOR
80NB
Float Valve
RCC OVER GROUND LUBRICATING WATER TANK CAP–5 CUM
GAA30 CL511
GAA30 CL011
From Service Water System
STANDBY PUMP START AT LOW
GAA20 CP011
GAA20 CP012
GAA20CF011
EFM
200NB
2330 m3/hr. (peak req)
324 m3/hr. (avg cont req)
TO ASH WATER TANK
TP PRESSURE AT 1.0 KG/CM2
PEM
ISG
TP: 5M AWAY FROM ASH WATER TANK
PW20
TO FIRE WATER TANK (Ref drg no: 4540-001-151-PVM-L-006
TP: 5M AWAY FROM FIRE WATER TANK
Max Raw Water required for AHP:
When AWRS is in operation =574 m3/hr
When AWRS is not in operation = 2580 m3/hr
(When BA and FA evacuation in wet mode)
GAA10 CP011
GAA10 CP012
GAA10CF011
3779 M3/Hr.
PTP–VENDOR
TO PT/DM CLARIFIER (SHEET NO. 2 OF 4)
R01

ग्राहक ड्राइंग संख्या / CUSTOMER DRAWING NO.: 4540-001-136-PVM-L-002

ग्राहक/CUSTOMER: एन टी पी सी लिमिटेड / N T P C LIMITED

परियोजना / PROJECT: 2X660 मेगावाट तालचर सुपर थर्मल पावर परियोजना लिमिटेड / 2X660MW TALCHER SUPER THERMAL POWER PROJECT LTD.

भारत हेवी इलेक्ट्रिकल्स लिमिटेड / BHARAT HEAVY ELECTRICALS LTD
पावर सेक्टर/POWER SECTOR
परियोजना अभियांत्रिकी प्रबंधन / PROJECT ENGINEERING MANAGEMENT
नोएडा (उ.प्र.)/NOIDA (U.P.)

कार्य संख्या / JOB NO.: 497
स्थिति / STATUS: CONTRACT

	NAME	SIGNATURE	DATE
DRN	AK		26.08.2022
CHKD	DKS		26.08.2022
	VKY		26.08.2022
APPD	GB		26.08.2022

DEPT CODE: N

शीर्षक/TITLE: P&ID–PLANT WATER SYSTEM

ड्राइंग संख्या / DRAWING NO.: PE-DG-497-172-N001

SCALE: NTS

SHEET: 1 OF 4

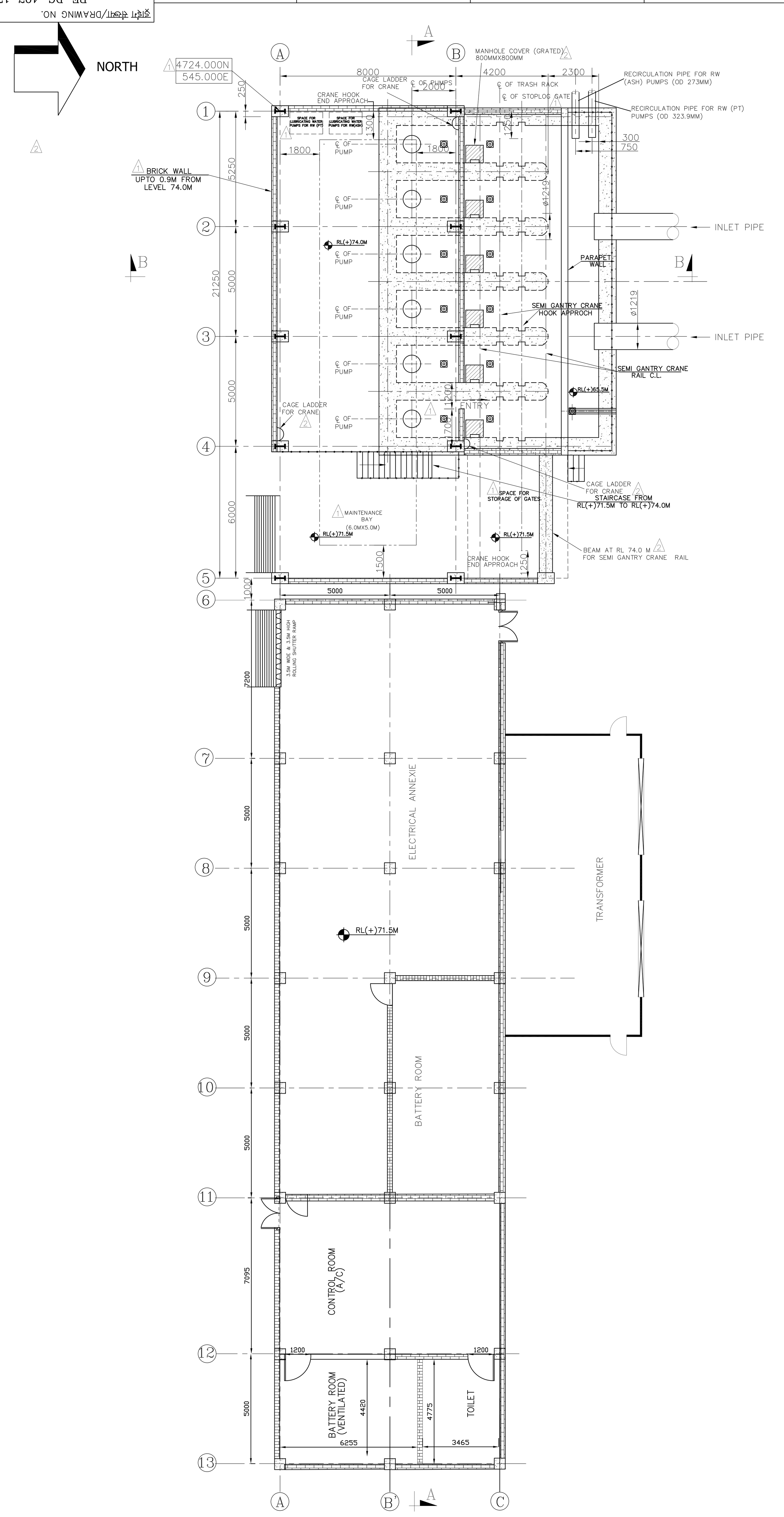
REV.: 01

फार्मेट साइज A0 / FORMAT SIZE A0

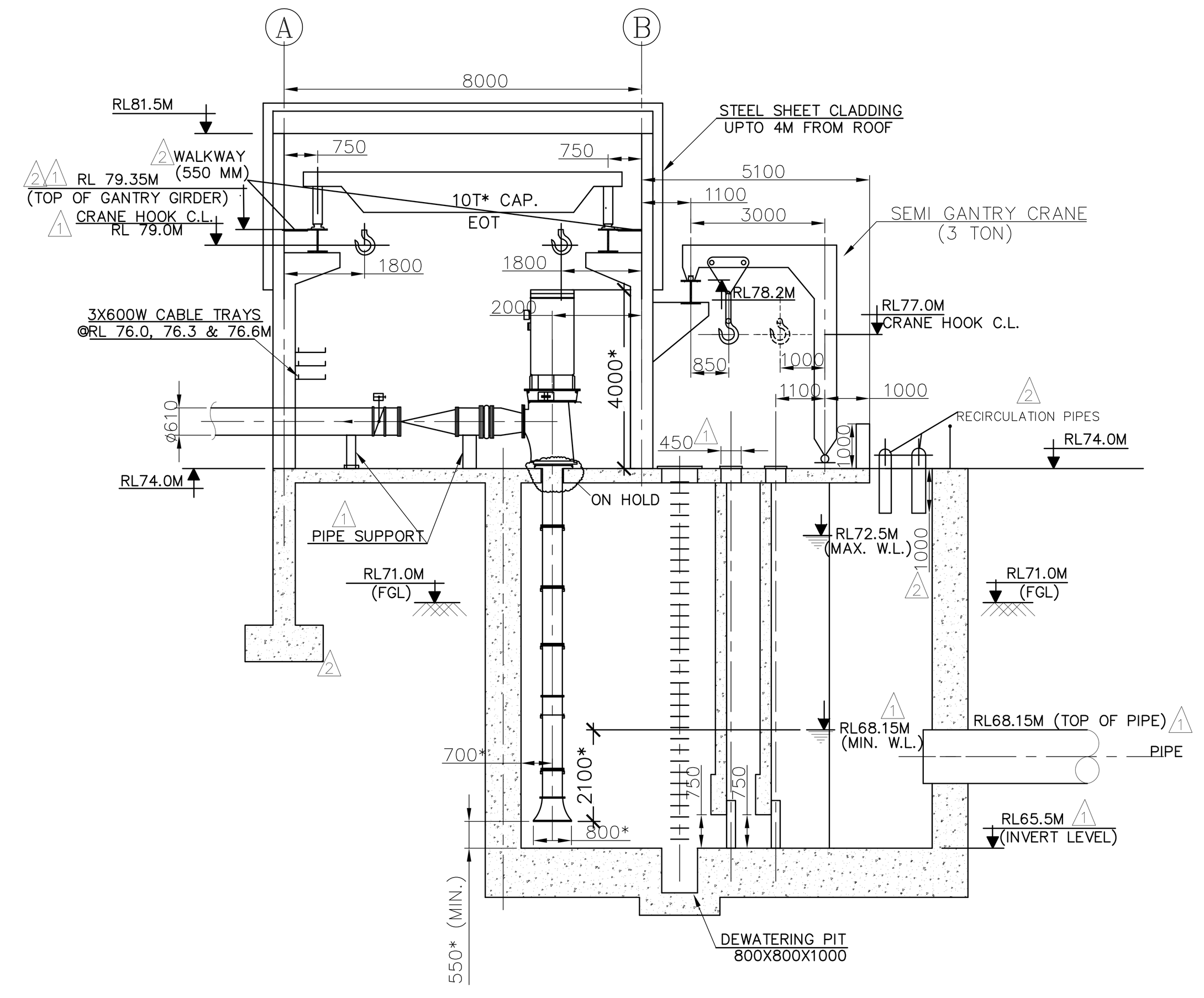
फस्ट एंगल प्रोजेक्शन/FIRST ANGLE PROJECTION

सभी माप मि मी में है/ALL DIMENSIONS ARE IN MM

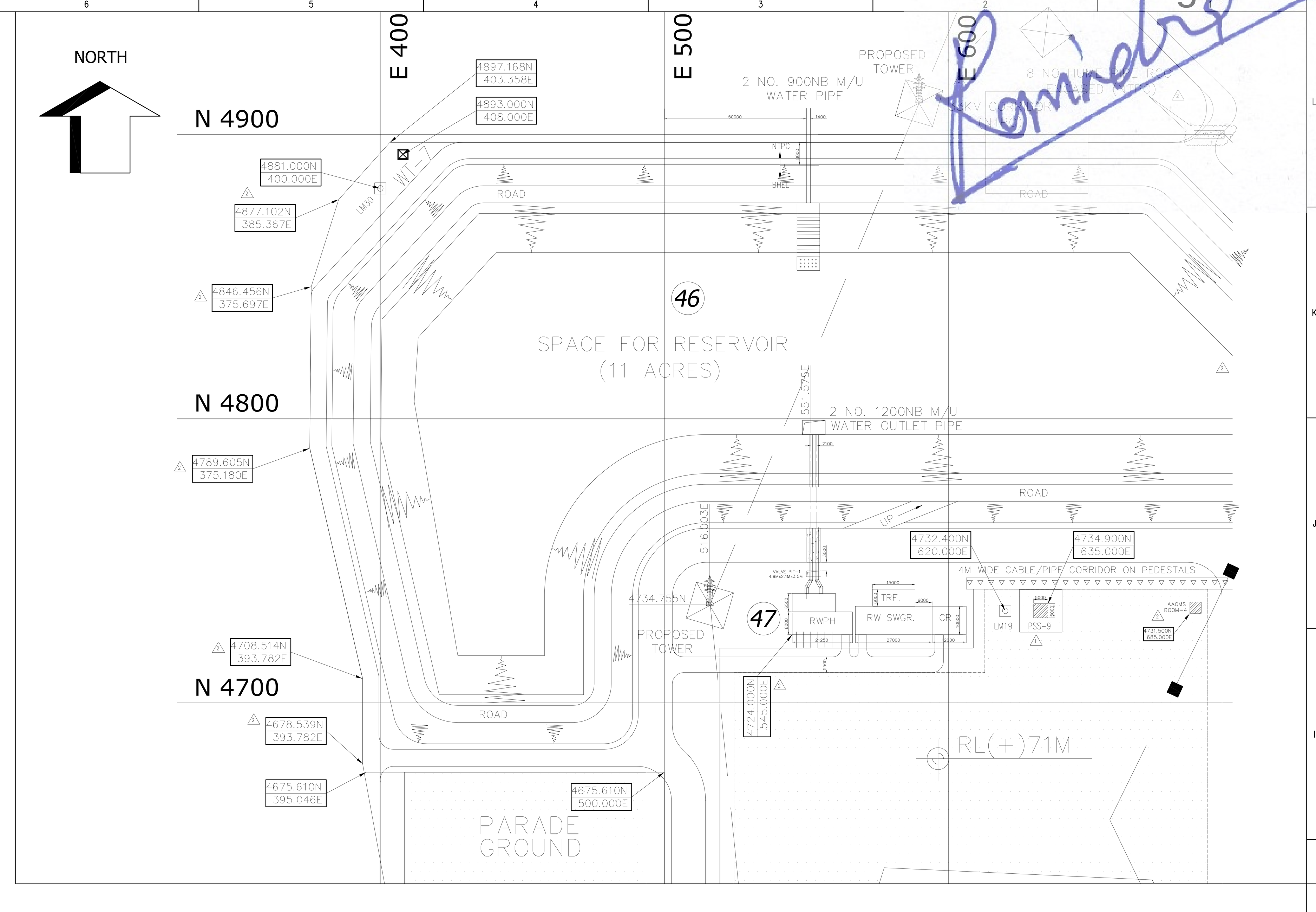
ड्राइंग संख्या/DRAWING NO. PE-DG-497-172-N004



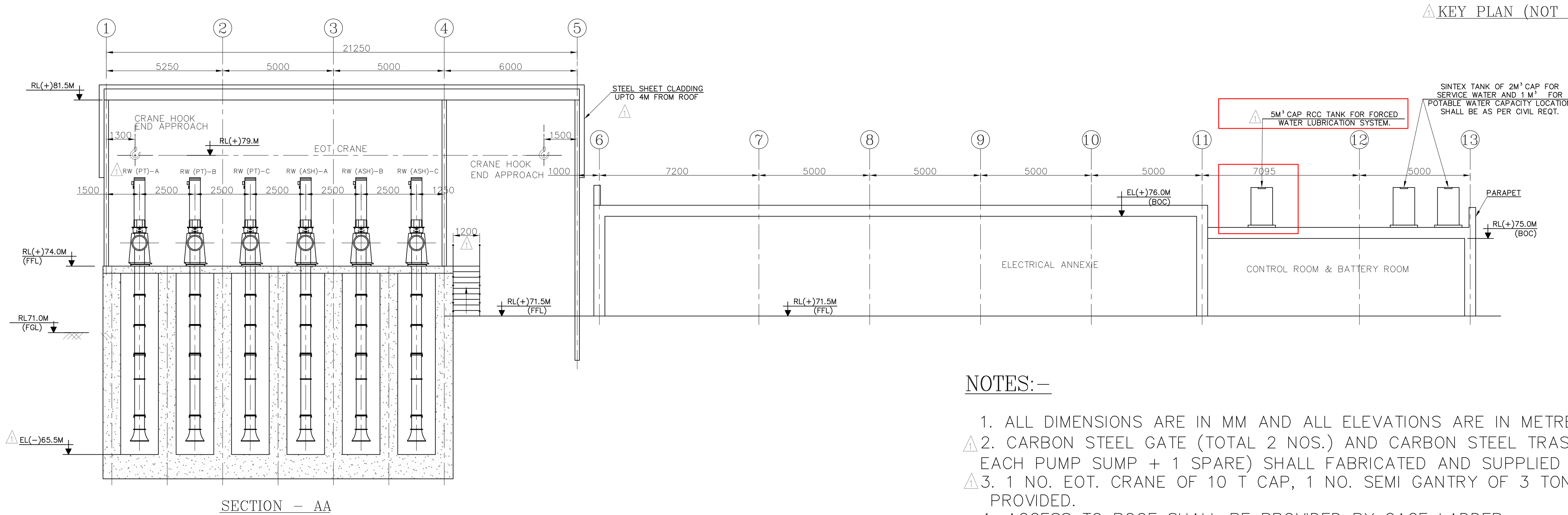
PLAN OF PUMP HOUSE



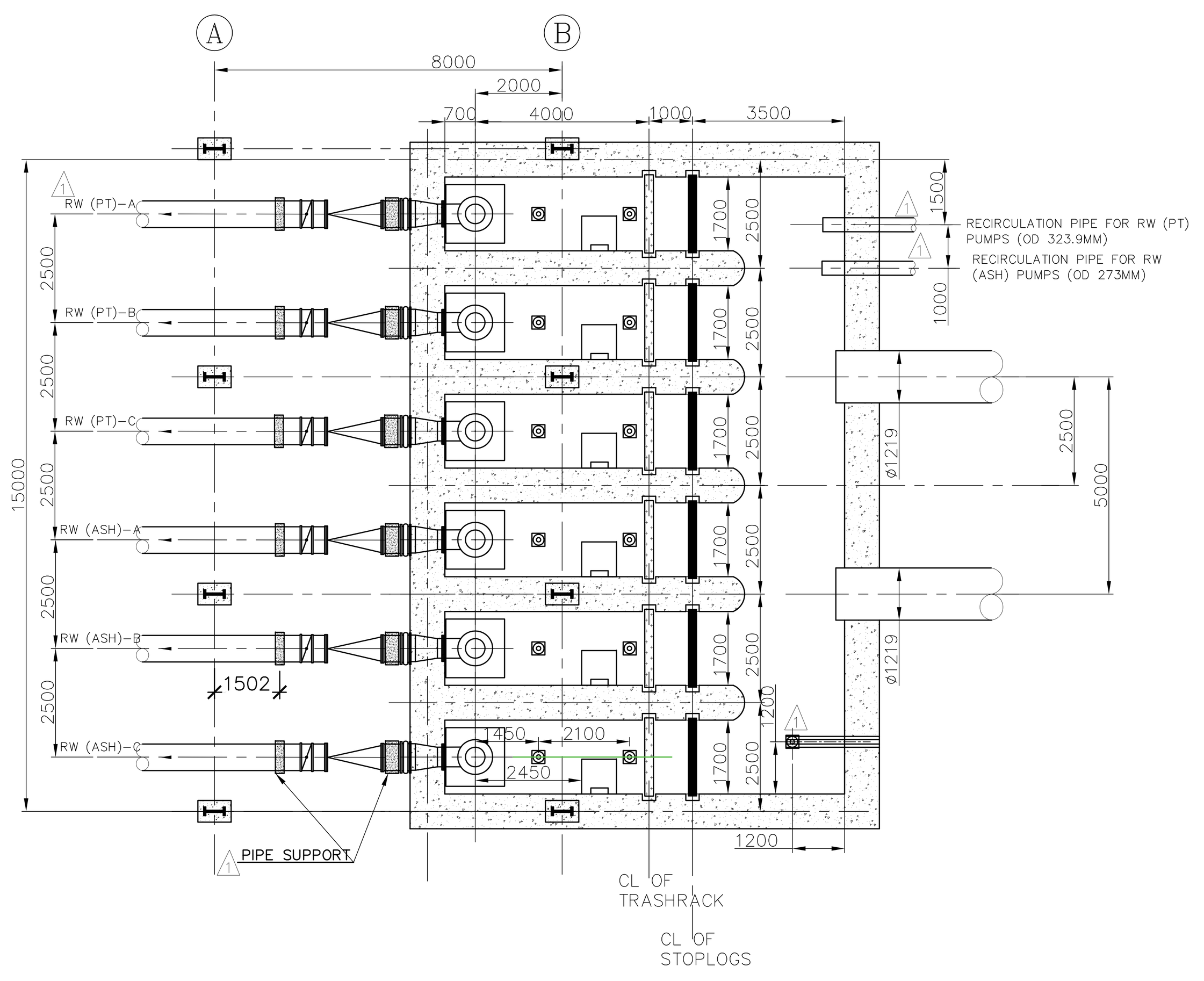
SECTION – BB



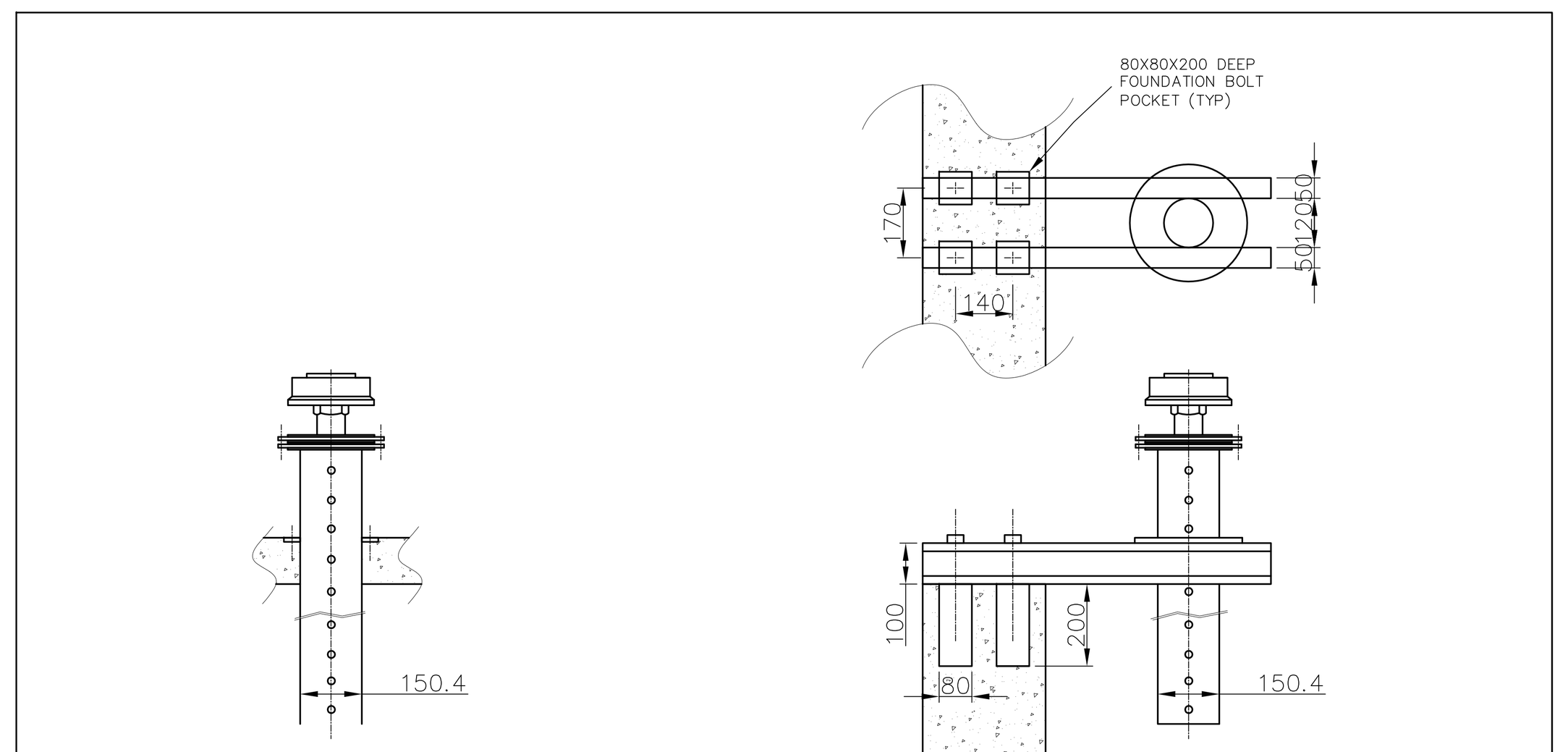
KEY PLAN (NOT TO SCALE)



SECTION – AA



SUMP PLAN OF RAW PUMP HOUSE



TYP. DETAIL OF LEVEL TRANSMITTERS IN SUMP

2 HOLES IN FLOOR FOR LEVEL TRANSMITTERS FOR EACH SUMP

LT VIEW (NOT TO SCALE)

TYP. DETAIL OF LEVEL TRANSMITTER IN FOREBAY

NOTES:-

1. ALL DIMENSIONS ARE IN MM AND ALL ELEVATIONS ARE IN METRES UNLESS OTHERWISE STATED.
2. CARBON STEEL GATE (TOTAL 2 NOS.) AND CARBON STEEL TRASH RACK (07 NOS. VIZ 1 NOS. FOR EACH PUMP SUMP + 1 SPARE) SHALL FABRICATED AND SUPPLIED BY BHEL-CIVIL CONTRACTOR.
3. 1 NO. EOT. CRANE OF 10 T CAP, 1 NO. SEMI GANTRY OF 3 TON CAPACITY SHALL BE PROVIDED.
4. ACCESS TO ROOF SHALL BE PROVIDED BY CAGE LADDER.
5. TRASH RACK & STOP LOG GATE HEIGHT SHALL BE DESIGNED FOR SUMP OPENING HEIGHT VIZ. 750MM.
6. 1 NO. PORTABLE STOOL CUM LADDER SHALL BE PROVIDED FOR ACCESS TO TOP BEARING OF MOTOR.
7. OPENINGS INSERTS ETC. REQUIRED FOR C&I INSERTS, PIPE/VALVE SUPPORTS ETC. SHALL BE INDICATED AFTER FINALIZATION OF RESPECTIVE INSTRUMENTS PIPE LAYOUT ETC.
8. MOUNTING ACCESSORIES FOR LTS LIKE FLANGE, COUNTER FLANGES & OTHER ACCESSORIES WILL BE PROVIDED.
9. ALL FIXING DETAILS FOR RECIRCULATION PIPE SHALL BE INDICATED IN THE CIVIL DRAWING.
10. FOR FB WALL DETAILS REFER DRG "ELECTRICAL EQUIPMENT & CABLING LAYOUT IN RAW WATER SWITCHGEAR ROOM (NTPC DRG NO. N4540-001-215-PVE-B-063)
11. REFERENCE DRAWINGS
    1. LAYOUT OF PIPING IN & AROUND RAW WATER PUMPS -DRG NO. PE-DG-497-100-M048
    2. ELECTRICAL EQUIPMENT & CABLING LAYOUT IN RAW WATER SWITCHGEAR ROOM (NTPC DRG NO. 4540-001-215-PVE-B-063)
    3. PHILOSOPHY FOR ELECTRICAL EQUIPMENT LAYOUT (DRG NO. 4540-001-299-PVE-U-001)
    4. CIVIL ARCHITECTURAL DRAWING (DRG NO. 4540-001-136-PVC-C-052 & 4540-001-136-PVC-C-053)

* THESE VALUES ARE NOT TO EXCEED VALUES BASED ON PAST PROJECT REFERENCES.

WATER LEVEL(ADJUSTABLE)

SL. NO.	DESCRIPTION	LEVEL
1	ADEQUATE	RL 69.15M
2	HIGH	RL 72.3M
3	VERY HIGH	RL 72.5M
4	LOW	RL 68.35M
5	VERY LOW	RL 68.15M

पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जांचकर्ता CHD	अनुमोदनकर्ता APPD	पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जांचकर्ता CHD	अनुमोदनकर्ता APPD	पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जांचकर्ता CHD	अनुमोदनकर्ता APPD
					02	08.06.23	ADK	ADK	VKY	01	18/05/23	ADK	ADK	VKY
					01	REVISED INLINE WITH CUSTOMER COMMENTS.				01	REVISED INLINE WITH CUSTOMER COMMENTS.			

कार्य संख्या- JOB NO. 497

स्थिति STATUS CONTRACT

मुद्रण स्केल मीटर में PRINT SCALE IN METRE

ग्राहक ड्राइंग संख्या CUSTOMER DRAWING NO. 4540-001-136-PVM-B-071

ग्राहक/CUSTOMER एन टी पी सी लिमिटेड N T P C LIMITED

परियोजना PROJECT 2X660 मेगावाट तालचर सुपर थर्मल पावर परियोजना लिमिटेड 2X660MW TALCHER SUPER THERMAL POWER PROJECT LTD.

भारत हेवी इलेक्ट्रिकल्स लिमिटेड BHARAT HEAVY ELECTRICALS LTD
पावर सेक्टर/POWER SECTOR
परियोजना अभियांत्रिकी प्रबंधन PROJECT ENGINEERING MANAGEMENT
नोएडा (उ॰प्र॰)/NOIDA (U.P.)

DEPT CODE N

	नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
तैयारकर्ता/DRN	AK		20.02.2023
डिजाइनकर्ता/DESN	ADK/DKS		20.02.2023
जांचकर्ता/CHD	VKY		20.02.2023
अनुमोदनकर्ता/APPD	GB		20.02.2023

शीर्षक/TITLE MECHANICAL GA OF RAW WATER PUMP HOUSE

एमपीएल MPL | सिविल CIVIL | इलेक्ट्रिकल ELEC | सीएण्डआई C&I | एमएसई MSE | मैक्स MAX | विभाग DEPT. | हस्ताक्षर SIGN | दिनांक DATE

स्केल – SCALE– 1:100

ड्राइंग संख्या/ DRAWING NO. PE-DG-497-172-N004

शीट SHEET 1 OF 1 पुनरीक्षण REV. 01 2

फॉर्मेट साइज A0 FORMAT SIZE A0

SUB-SECTION – IB

SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)

1676260/2023/20230823

REV: 0 DATE: 06.09.2023

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

PACKAGE: MISC. PUMP (Supply Package)

PROJECT: 2 X 660 MW TALCHER TPP

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
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.

1676260/2023/20230823

TECHNICAL DATASHEET

S.No.	Parameters	Requirement
1	Applicable Standards	1) Three phase induction motors : IS:325, IEC:60034, IS:12615, IS: 15999 2) Single phase AC motors : IS:996, IEC:60034 3) Energy Efficient motors : IS 12615, IEC:60034-30
2	Rated voltage	415V, 3 Phase
3	Frequency (Hz)	50Hz
4	Permissible variations for	
	a) Voltage	+/-10%
	b) Frequency	+3% & -5%
	c) Combined	10% (Sum of absolute values)
	System fault level at rated voltage	50KA for 1 sec
	Short time rating for terminal boxes	50KA for .25 sec
5	Type of motors	Continuous duty squirrel cage induction motor suitable for direct-on-line starting
6	Efficiency class	IE3 Class confirming to IS 12615 or IEC:60034-30
7	Design margin over continous max. demand of the driven equipment (min)	10%
8	Starting requirement	
	a) Minimum permissible voltage as a percentage of rated voltage, at start to bring the driven equipment upto the driven equipment upto rated speed	(a) Below 110KW : Up to 85% of rated voltage (b) From 110 KW & upto 200 KW : Up to 80% of rated voltage
	b) Maxmum locked rotor current	as per IS 12615
	c) Starting duty	Two hot starts in succession, with motor initially at normal running temperature.
	d) the locked rotor withstand time under hot condition at highest voltage limit	a) atleast 2.5 secs. more than starting time(for motors with starting time upto 20 secs. at minimum permissible voltage during starting b)atleast 5 secs. more than starting time(for motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting c) more than starting time by at least 10% of the starting time(For motors with starting time more than 45 secs.at minimum permissible voltage during starting d) Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.
	e)The ratio of locked rotor KVA at rated voltage to rated KW	(a) Below 110KW : 11.0 (b) From 110 KW & upto 200 KW : 9.0
9	Torque (percent of full load torque)	1] Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque. 2]Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.
10	Noise level (max.)	85dB(A)
11	Vibration shall be limited within the limits	as per IS:12075 / IEC 60034-14
12	Construction Features	
(i)	Enclosure Details	
	a) Degree of protection	i) Indoor motors - IP 55 ii) Outdoor motors - IP 55 (Additional Canopy to be provided)
	b) Method of ventilation	Totally enclosed fan cooled (TEFC) or totally enclosed tube or ventilated (TETV) or Closed air circuit air cooled (CACA) type.
(ii)	Insulation	Class F temperature rise limited to class -B
(iii)	Bearings	Grease lubricated ball or roller bearings for Horizontal motors Grease lubricated ball or roller bearings or combined trust and guide beaing for Vertical motors
(iv)	Winding Type	Electrolytic grade Copper conductor, Non hygroscopic, oil resistant, flame resistant Insulation.
13	Main terminal box	
(i)	Type	-Motor terminal box shall be detachable type and located in accordance with Indian Standards clearing the motor base- plate/ foundation. -Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame. - The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.
(ii)	DOP	same as motor
(iii)	Position when veiwed from the non driving end	- Left hand side
(iv)	Rotation	90 Deg.
(v)	Space heater	Motors rated 30KW and above sapce heater required.Separate terminal box for space heaters & RTDs shall be provided.

(vi)	Cable glands and lugs	-Motor terminal box shall be furnished with suitable cable lugs and double compression brass glands to match with cable used. Cable glands shall conform to BS:6121. 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 lugs/ferrules shall be solderless crimping type suitable for power and control cables as per the DIN 46239. Aluminium solderless crimping lugs/ ferrules shall be used for Aluminium cables and Copper lugs/ferrules shall be used for Copper cables. Bimetallic washers or bimetallic type lugs shall be used for bimetallic connections.
(vii)	DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS:	
	Motor MCR in KW	**Minimum distance between centre of stud and gland plate in mm**
	a) UP to 3 KW	As per manufacturer's practice.
	b) Above 3 KW - upto 7 KW	85
	c) Above 7 KW - upto 13 KW	115
	d) Above 13 KW - upto 24 KW	167
	e) Above 24 KW - upto 37 KW	196
	f) Above 37 KW - upto 55 KW	249
	g) Above 55 KW - upto 90 KW	277
	h) Above 90 KW - upto 125 KW	331
	i) Above 125 KW-upto 200 KW	203
	j) For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm.	
(viii)	**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**
	a) UP to 110 KW	10mm
	b) Above 110 KW and upto 150 KW	12.5mm
	c) Above 150 KW	19mm
14	Earthing points (2 nos. on diagonally opposite sides) suitable for connection	GS Flat- 50 x 6 OR 25 X 6 OR 25 X 3
15	Paint shade	RAL 5012 (Blue)/Light grey finish No. 631 as per IS: 5 (subject to customer approval)
16	**LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED**	
	a) The following type test reports shall be submitted for each type and rating of LT motor of above 100 KW only	
	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(Noise level for all the motors shall be limited to 85dB (A) except for BFP motor for which the maximum limit shall be 90 dB(A). Vibration shall be limited within the limits prescribed in IS/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.)	
	10. Test for degree of protection and	
	11. Overspeed test.	
	12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1	
	13. The type test listed above should have been conducted within 10 yrs from 06.06.2022. In absence of type tests reports or in case reports are not found to be meeting the specification/standards requirements, vendor shall conduct all such type tests without any commercial/delivery implication to BHEL according to the relevant standards and reports shall be submitted to the owner for approval.	
	14. For Motor rating upto 50KW, BHEL QP No.PE-QP-999-Q-006, REV -02 is to be followed & for Motor rating above 50KW, NTPC RQP, QP No. 0000-999-QVE-P-044, Rev. No. :4 is to be followed.	
	b) 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.	
	c) 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.	

DATA TO BE FURNISHED BY SUCCESSFUL BIDDER AFTER ORDERING

1. GENERAL		
i)	Manufacturer & Country of origin.	
ii)	Equipment driven by motor)	
iii)	Motor type	
iv)	Country of origin	
v)	Quantity	
2. DESIGN AND PERFORMANCE DATA		
i)	Frame size	
ii)	Type of duty	
iii)	Type of enclosure and method of cooling	
vi)	Type of mounting	
vii)	Direction of rotation as viewed from DE END	
viii)	Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)	
ix)	(A) Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)	
	(B) Rating as specified in load list/Maximum continuous load demand of driven equipment	
xi)	Rated speed at rated voltage and frequency	
xii)	At rated Voltage and frequency	
	a) Full load current (Amps)	
	b) No load current (Amps)	
xiii)	Power Factor at	
	a) 100% load	
	b) At duty point	
	c) 75% load	
	d) 50% load	
	e) NO load	
	f) Starting.	
xiv)	Efficiency at rated voltage and frequrecy	
	a) 100% load	
	b) At duty point	
	c) 75% load	
	d) 50% load	
xv)	Starting current (amps) at	
	a. 100 % voltage	
	b. 85% voltage	
	c. 80% voltage	
xvi)	Starting time with minimum permissible voltage	
	a. Without driven equipment coupled	
	b. With driven equipment coupled	
xvii)	Safe stall time with 110% of rated voltage	
	a. From hot condition	
	b. From cold condition	
xviii)	**Torques :**	
	a. Starting torque at min. permissible voltage(kg-mtr.)	
	b. Pull up torque at rated voltage.	
	c. Pull out torque	
	d. Min accelerating torque (kg.m) available	
	e. Rated torque (kg.m)	
xix)	Stator winding resistance per phase (ohms at 20 Deg.C.)	
xx)	GD^2 value of motors	
xxi)	Locked rotor KVA input (at rated voltage)	
xxii)	Locked rotor KVA/KW.	
xxiii)	**Bearings**	
	a. Type	
	b. Manufacturer	
	c. Self Lubricated or forced Lubricated	
	d. Recommended Lubricants	
	e. Guaranteed Life in Hours	
	f. Whether Dial Type thermometer provided	
	g. Oil pressure Gauge/switch	
	i. Range	
	ii. Contact Nos. & ratings	
	iii. Accuracy	
xxiv)	**Vibration**	
	a) Velocity (mm/s)	
	b) Displacement (microns)	
xxv)	Noise level (DB)	
3. CONSTRUCTIONAL FEATURES		

i)	Stator winding insulation	
	a. Class & Type	
	b. Tropicalised (Yes/No)	
	c. Temperature rise over specified max.	
	i. Cold water temperature of 38 DEG. C.	
	ii. Ambient Air 50 DEG. C.	
	d. Method of temperature measurement	
	e. Stator winding connection	
	f. Number of terminals brought out	
ii)	Type of terminal box for	
	a. stator leads	
	b. space heater	
	c. Temperature detectors	
	d. Instrument switch etc.	
iii)	For main terminal box	
	a. Location	
	b. Entry of cables	
	c. Recommended cable size	
	d. Fault level (MVA)	
	e. No. of Eathing Pads	
iv)	Temperature detector for stator winding	
	a Type	
	b. Nos. provided	
	c . Location	
	d. Make	
	e. Resistance value at 0 deg. C. (ohms)	
vi)	Paint shade	
vii)	Weight of(approx)	
	a. Motor stator (KG)	
	b. Motor Rotor (KG)	
	c. Total weight (KG)	
4. LIST OF CURVES		
i)	Torque speed characteristic of the motor	
ii)	Thermal withstand characteristic	
iii)	Starting. current Vs. Time	
iv)	Starting. current Vs speed	
v)	P.F. and Effi. Vs Load	

NOTE :

1. THESE DETAILS ARE IN ADDITION TO THE DETAILS MENTIONED IN SHEET- I & 2 OF DATASHEET. SHEET - 3 & 4 SHOULD BE READ IN CONJUCTION TO SHEET - I & 2
2. DURING CONTRACT STAGE : SUCCESSFUL BIDDER TO STAMP & SIGN SHEET - I & 2 OF DATASHEET, AND APPEND DULY FILLED UP STAMPED & SIGNED SHEET -3 & 4 OF DATASHEET FOR BHEL/CUSTOMER'S APPROVAL.

SUB-SECTION – IC

SPECIFIC TECHNICAL REQUIREMENTS (C&I)

SPECIFIC TECHNICAL REQUIREMENT	
Sl.No.	**Items / Requirements**
1	Lubricating water system shall be controlled through DDCMIS(BHEL scope)
2	Bidder to provide Profibus PA protocol compatible PT(Pressure Transmitters) for Lubricationg Water System package.
3	Reverse Rotation Indicator shall be in Bidder's scope of supply.
4	Flow switches ,Rotameters, Pressure Gauges etc. shall be provided by the Bidder
5	Bidder to provide RTD for Pump Bearing Temperature Measurement for Horizontal Pumps package
6	The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds,Junction Boxes and all the other accessories required for mounting/erection of local / remote instruments shall be provided by Vendor. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg./sq.cm.

REFERENCE CODES AND STANDARDS FOR CONTROL AND INSTRUMENTATION		
	Pressure Measurements	
1.a	Instruments and apparatus for pressure measurement	ASME PTC19.2 (1964)
1.b	Electonic transmitters	BS-6447
2	Bourdon tube pressure and vacuum gauges	IS-3624 : 1966
3	Process operated switch devices (Pr. Switch)	BS-6134
	Process Connection, Piping & Instrument tubing	
1	Codes for pressure piping "power piping"	ANSI B 31.1
2	Seamless carbon steel pipe	ASTM - A - 106
3	Forged & Rolled Alloy steel pipe flanges, forged fittings and valves and parts	ASTM - A - 182
4	Material for socket welded fittings	ASTM - A - 105
5	Seamless ferritic alloy steep pipe	ASTM - A - 335
6	Pipe fittings of wrought carbon steel and alloy steel	ASTM - A - 234
7	Composition bronze of ounce metal castings	ASTM - B - 62
8	Seamless Copper tube, bright annealed	ASTM - B - 168
9	Seamless copper tube	ASTM - B - 75
10	Dimension of fittings	ANSI - B - 16.11
11	Valves flanged and butt welding ends	ANSI - B - 16.34
12	Code of practice for instrumentation in process control systems: installation design and practice	BS 6739:2009
13	Fossil Fuel Power Plant Instrument Piping Installation	ISA 77.70

DATASHEET OF PRESSURE TRANSMITTER		
Sl.NO.	**ITEM**	**DETAILS**
1	Fluid Handled	Raw water
2	Transmitter Type	Microprocessor based 2 Wire Loop powered
3	Output	Profibus PA complying to IEC 61158
4	Turndown Ratio	50:1
5	Accuracy	0.06%
6	Stability (% of Calibrated Range)	+/-0.25% for 10 year
7	Diaphragm Seal material, fill fluid	Hastelloy C, Inert Liquid
8	Wetted parts	All wetted parts upto diaphragm seal shall be suitable for chemical application
9	Housing	Metallic housing with durable corrosion resistant coating
10	Protection	Weather Proof IP-67
11	Display	Integral digital display
12	Diagonstic feature	Required
13	Electrical Connection	1/2" NPT (F)
14	Manifold	2/3/5 Valve non integral manifold

DATASHEET OF PRESSURE GAUGE/DP Gauge		
Sl. No	**FEATURES**	**ESSENTIAL/MINIMUM REQUIREMENTS**
		Pr. Gauge/ DP Gauge
1	Sensing Element and material	Bourdon for high pressure, Diaphragm/Bellow for low pressure of SS316, movement material SS316
2	Body material	SS316
3	Dial size	150mm
4	End connection	1/2 inch NPT (M)
5	Accuracy	±1% of span
6	Scale	Linear, 270° arc graduated in metric units
7	Range selection	Cover 125% of max. of scale
8	Diaphragm seal material, fill fluid	Hastelloy C, Inert Liquid suitable for application
9	Wetted parts	All wetted parts upto diaphragm seal shall be suitable for chemical application
10	Housing	Weather and dust proof as per IP-55
11	Zero/span adjustment	External
12	Accessories	Blow out disc, siphon, snubber, pulsation, dampener, chemical seal, gauge isolation valve

ROTAMETERS		
Sl. No.	Features	Essential / minimum requirements
1	Type	Variable Area Metal Tube
2	Fluid media	Water/oil
3	Tube body	SS316
4	Material of float	SS316
5	Indicator	Linear scale
6	Accessories	Flange, orifice in case of bypass Rota meter (for line size above 100 mm)
7	Housing protection class	IP-55
8	Accuracy	± 2% of measured value.

FIELD MOUNTED LOCAL JUNCTION BOXES		
1	No. of ways	12/24/36/48/64/72/96/128 with 20% spares terminals.
2	Material and Thickness	4mm thick Fiberglass Reinforced Polyester (FRP).
3	Type of terminal blocks	Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm2. A M6 earthing stud shall be provided.
4	Protection Class	IP: 55 min. for indoor & IP-65 min for outdoor applications.
5	Grounding	To be provided
6	Color	RAL 7035
7	Spare Terminals	At least 20% unused terminals
Note: Number of Junction boxes shall be sufficient and positioned in the field to minimize local cabling.		

SOLENOID VALVES		
	FEATURES	**Requirement**
	Type	2/3/4 way SS 316/Forged Brass
	Power supply	24 V DC + 10%.
	Electrical connection.	Plug and socket
	Insulation class	Class 'H'
	IP Class	IP65

REVERSE ROTATION INDICATOR
Reverse rotation indicator comprising of proximity sensors, processing electronics with output of 4-20mA (corresponding to speed) interconnecting cables, speed display in rpm, normal, reverse indication and required channel alarm contact shall be provided. The contact rating shall be 60VDC, 6VA (or more if required by Control system). The exact details of the RRI shall be strictly as approved by Employer during detailed engineering. The power supply of RRI is to be arranged by the Bidder.

PROCESS CONNECTION PIPING	
The rating of material of impulse pipes, tubes, fittings, valves and their installation thereof shall conform to the latest edition of	
Impulse Pipes, Tubes (Material, Rating)	ANSI B31.1, ANSI B31.1a, ANSI/ISA 77.70
Valves (Material, Pr. Class, Size)	ASTM A182/ASTM A105 as per ASME 16.34
Fittings (Size, Rating, Material)	ANSI B31.1, ANSI B31.1a, ASME B16.11
Installation Schemes	BS 6739-2009, ANSI/ISA 77.70

Limit Switches	
The Limit switches shall be silver plated with high conductivity and non corrosive type.	
Features	**Requirements**
Operating voltage Range	10-40 V DC
Sensing system	Inductive Proximity type , 2 Wire
Sensor Contact Type	NO
Reverse polarity and short circuit protection	Yes
IP Class-Sensor	IP67
IP Class-Enclosure(Switch box)	IP67
Cable entry-Enclosure(Switch box)	2no-1/2" NPT
Casing material-Sensor	Brass /SS
Enclosure(Switch box) Housing material	FRP or SS
Operating Ambient temp(sensors)	-5 to 70 deg C
Max allowed Voltage Drop across sensor	5 V
Standard applicable	EN 60947-5-2 or equivalent.

Resistance Temperature Detector (RTD)		
Sr. No.	**Features**	**Essential/Minimum Requirements**
1	Type of RTD.	Four wire, Pt-100 (100 Ohms resistance at zero degree Centigrade).
2	No. of element	Duplex
3	Housing/Head	IP-65/Diecast Aluminium. Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter (as applicable). Plug in connectors are to be provided for external signal cable connection. TE terminal head shall be spring loaded for positive contacts with the thermo well
4	Insulation and sheathing of RTD	Mineral (magnesium oxide) insulation and SS316 sheath
5	Calibration and accuracy	As per As per IEC-751/ DIN-43760 Class-A for RTD
6	Accessories	Thermo well and associated fittings
7	Standard	IEC-751/ DIN-43760 for RTD and ASME PTC- 19.3 for Thermo-well.

The specifications for RTDs of winding/ bearings of motor/pump, can be as per their manufacturer standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice. However the type of RTD shall be Pt100.
Thermowell shall be one piece solid bored type of 316 SS of step-less tapered design. (As per ASME PTC 19.3, 1974)

MEASURING INSTRUMENTS									
Item Components Sub System Assembly	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Test as per standard(R)	Insulation Resistance (R)	IBR Certification (As applicable)(R)	Hydro Test(R)	Material Test certificate (R)
Pressure Gauge (IS-3624)	Y	Y	Y	Y	Y				
Pressure /Differential Pressure Switch(BS-6134)	Y	Y	Y	Y	Y	Y			
Electronic Transmitter(IEC-60770)	Y	Y	Y	Y	Y	Y			
Electrical Metering Instrument (IS-1248)	Y	Y	Y	Y	Y	Y			
Transducer (IS-14570)	Y	Y	Y	Y	Y	Y			
RTD(IS-2848)	Y	Y	Y	Y	Y	Y			
R-Routine Test A- Acceptance Test Y – Test applicable									
Note: This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted along with relevant supporting documents.									

PROCESS CONNECTION AND PIPING													
Tests Items	Visual & Dimensions ®	GA, BOM, Layout of component & construction feature, Paint Shade/thickness	Flattening,flaring,hydrotest,hardness check as per ASTM standard (A)	Component Ratings ®	Wiring ®	Make, Model, Type, Rating®	IR & HV ®	Review of TC for instrument/devices (R)	Accessability of TBs/Devices Illumination,grounding ®	Tubing ®	Leak/Hydro test(A)	Chemical/physical properties of material (A)	Proof pressure test,Dismantling & reassembly test Hydrulic impulse and	Tests as per standards & specification
Local Instrument enclosure	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y			
Local instruments racks	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y			
Junction Box	Y	Y*		Y		Y	Y							
Gauge Board	Y	Y		Y		Y		Y		Y	Y			
Impulse pipes and tubes	Y		Y			Y						Y		
Socket weld fittings ANSI B-16.11	Y					Y						Y		Y
Compression fittings	Y					Y					Y	Y	Y	
Instrument valves & Valve manifolds	Y					Y					Y	Y		
Copper tubings ASTM B75	Y					Y								Y
*-applicable for painted junction boxes.														
®-Routine Test A-Acceptance Test Y – Test applicable														
Note: This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted alongwith relevant supporting documents.														

General Requirement	
1	Out of the tests listed, the Bidder/ sub-vendor/ manufacturer is required to conduct certain type tests specifically for this contract (and witnessed by Employer or his authorized representative) even if the same had been conducted earlier, as clearly indicated subsequently against such tests.
2	For the rest, submission of type test results and certificate shall be acceptable provided:
2.1	The same has been carried out by the Bidder/ sub-vendor on exactly the same model /rating of equipment.
2.2	There has been no change in the components from the offered equipment & tested equipment.
2.3	The test has been carried out as per the latest standards alongwith amendments as on the date of Bid opening.
3	In case the approved equipment is different from the one on which the type test had been conducted earlier or any of the above grounds, then the tests have to be repeated and the cost of such tests shall be borne by the Bidder/ sub-vendor within the quoted price and no extra cost will be payable by the Employer on this account.
4	The schedule of conduction of type tests/ submission of reports shall be submitted and finalized during pre-award discussion.
5	For the type tests to be conducted, Contractor shall submit detailed test procedure for approval by Employer. This shall clearly specify test setup, instruments to be used, procedure, acceptance norms (wherever applicable), recording of different parameters, interval of recording precautions to be taken etc. for the tests to be carried out.

Type Test Requirement for C&I					
Sl.No	Item	Test Requirement	Standard	Test To Be Specifically Conducted	NTPC's Approval Req. on Test Certificate
1	Electronic transmitter	As per standard	BS-6447 / IEC-60770	No	Yes

SUB-SECTION – ID

DATASHEET-A

	DATA SHEET - A	SPECIFICATION NO.:	PE-TS-497-100-W001
	MISCELLANEOUS PUMPS (VERTICAL)	**REV. NO.: 00**	**DATE** : 06/09/2023
	2X660 MW TALCHER TPP	**SECTION:**	**I D**
Sl. No.	**DESCRIPTION**	**RAW WATER (PT) PUMPS**	**RAW WATER (ASH) PUMPS**
1.0	**SERVICE**		
1.1	Total no. of pumps for Project	3	3
1.2	No. of working & standby pumps	2W+1S	2W+1S
1.3	Liquid Handled (ref. water analysis enclosed herein)	Raw water	Raw water
1.4	Location	Raw water Pump House	Raw water Pump House
1.4.1	Indoor / Outdoor	Outdoor	Outdoor
1.5	Duty	Continuous	Continuous
1.6	Specific gravity	1	1
1.7	No. of pumps working in parallel	2	2
1.8	System design pressure (kg/sqcm), g	10	10
2.0	**DESIGN PARAMETERS**		
2.1	Design capacity each, M^3/hr	2133	1165
2.2	Total dynamic head (MWC) **(Developed Pump head at Min WL, excluding Pumps Internal frictional losses upto discharge)**	21	35
2.3	• Suction Pressure(MWC)	Submerged Suction	Submerged Suction
	• Floor Level- for Pump Mounting	RL 74.00 M	RL 74.00 M
	• Min. W.L	RL 68.15 M	RL 68.15 M
	• Max. W.L.	RL 72.50 M	RL 72.50 M
	• Sump Invert Level	RL 65.50 M	RL 65.50 M
	• Crane Hook Level	RL 79.00 M	RL 79.00 M
	• Crane Capacity Available	10 Ton	10 Ton
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 90 MWC
2.7	Pump Discharge - above floor / below floor	Above Floor	
2.8	Operating range	40-120% of rated duty point flow	
2.9	Motor rating	Continuous motor rating (at 50 deg C ambient) for all pumps shall be at least ten per cent (10%) above the maximum load demand of the driven equipment in the complete operating range (including run out condition) to take care of the system frequency/voltage variation.	
2.10	Permissible tolerance in rated capacity & TDH	no negative tolerance	
2.11	Permissible tolerance in efficiency at rated capacity(%)	no negative tolerance	
2.12	Performance/Design Standard	HIS	
3.0	**CONSTRUCTION FEATURES**		
3.1	Pump type	Vertical Wet Pit & Non-Pull out type	Vertical Wet Pit & Non-Pull out type
3.2	Impeller type	Closed / Semi open	Closed / Semi open
3.3	Casing type	Vertical Turbine Type	Vertical Turbine Type
3.4	Coupling type	Flexible	Flexible
3.5	Sealing arrangement	Self Water / Gland	Self Water / Gland
3.6	Type of Lubrication	Forced Lubrication	Forced Lubrication
	Liquid for Lubrication	Service Water from Service Water Tank located at Control Room of Raw Water Pump House (Refer cl no. 3.3 of Section-IA for details)	
3.7	Pump characteristics	Non Overloading type & stable	Non Overloading type & stable
3.8	Drain Plugs, vent with valve, lifting lugs, etc.	To be Provided	
3.9	Thrust Bearing location	As per Bidder's proven design	As per Bidder's proven design
4.0	**MATERIALS OF CONSTRUCTION**		
4.1 (a)	Casing & Suction Bell	2.5 % Ni CI to IS 210 Gr. FG 260 (S - 0.1% max and P - 0.15% max)	2.5 % Ni CI to IS 210 Gr. FG 260 (S - 0.1% max and P - 0.15% max)
4.1 (b)	Casing Liner	Stainless Steel (SS)	Stainless Steel (SS)
4.2	Column Pipe	Fabricated steel as per IS: 2062 with 2 coats of epoxy coating inside & outside	Fabricated steel as per IS: 2062 with 2 coats of epoxy coating inside & outside
4.3	Minimum column pipe thickness, mm	10 mm	10 mm
4.4	Impeller	Austenitic SS ASTM A743 CF8M Grade	Austenitic SS ASTM A743 CF8M Grade
4.5	Shaft/ Line Shaft	SS - ASTM A 276 Gr. 410	SS - ASTM A 276 Gr. 410
4.6	Shaft Sleeves	SS - ASTM A 276 Gr. 410	SS - ASTM A 276 Gr. 410
4.7	Shaft Coupling	SS - ASTM A 276 Gr. 410	SS - ASTM A 276 Gr. 410

	DATA SHEET - A	SPECIFICATION NO.:	PE-TS-497-100-W001
	MISCELLANEOUS PUMPS (VERTICAL)	**REV. NO.: 00**	**DATE** : 06/09/2023
	2X660 MW TALCHER TPP	**SECTION:**	**I D**
Sl. No.	**DESCRIPTION**	**RAW WATER (PT) PUMPS**	**RAW WATER (ASH) PUMPS**
4.8	Wearing rings	SS-316	SS-316
4.9	Wetted fasteners	SS-316	SS-316
4.10	Fasteners (others)	High Tension Carbon Steel	High Tension Carbon Steel
4.11	Gland plate	2.5 % NI-CI to IS-210 FG-260	2.5 % NI-CI to IS-210 FG-260
4.12	Lantern Ring (if applicable)	As per manufacturer's practice	As per manufacturer's practice
4.13	Intermediate stage bearings	Cutless rubber with bronze retainer for below minimum water level and Thordon type for above minimum water level.	Cutless rubber with bronze retainer for below minimum water level and Thordon type for above minimum water level.
4.14	Mech. seal	NA	NA
4.15	Gland Packing	Impregnated Teflon (Asbestos Free)	Impregnated Teflon (Asbestos Free)
4.16	Base/ Sole Plate	Fabricated steel as per IS: 2062 (Min 12.0 mm thick) Epoxy coated	Fabricated steel as per IS: 2062 (Min 12.0 mm thick) Epoxy coated
4.17	Thrust pad	Carbon Steel with White Metal Lining	Carbon Steel with White Metal Lining
4.18	Thrust bearing cooling system Piping & Valves (as applicable)	SS	SS
4.19	Connecting Pipe material (for deciding counterflange material)	Piping shall be Carbon Steel (IS:2062, Gr. B), rolled and welded conforming to IS:3589 .	Piping shall be Carbon Steel (IS:2062, Gr. B), rolled and welded conforming to IS:3589 .
4.20	Discharge head	Fabricated steel as per IS: 2062 (minimum thickness - 10 mm) with 2 coats of epoxy coating inside & outside.	
4.21	Shaft Enclosing Tubes	Fabricated steel as per IS: 2062 (minimum thickness - 6 mm) with 2 coats of epoxy coating inside & outside.	
5.0	**MANDATORY SPARES**		
5.1	**Mandatory Spares for Vertical Pump-Motor Set**		
5.1.1	Impeller with nuts & washers	1 set	1 set
5.1.2	Bearings for Line, Head and Impeller shafts	1 set	1 set
5.1.3	Thrust Bearings of pump & drive	1 set	1 set
5.1.4	Wearing rings – Impeller (if applicable)	1 set	1 set
5.1.5	Wearing rings – Casing (if applicable)	1 set	1 set
5.1.6	Gland, packing & gland assembly	1 set	1 set
5.1.7	Impeller Shaft, line shaft and head shaft	1 set	1 set
5.1.8	Shaft Sleeves	1 set	1 set
5.1.9	Stuffing box	1 set	1 set
5.1.10	Pump & Drive Coupling, bushes, pins with all fasteners & coupling guards (as applicable)	1 set	1 set
5.1.11	All Gaskets	1 set	1 set
5.1.12	Motor Bearings	1 set	1 set
5.1.13	Line Shaft Couplings (if applicable)	1 set	1 set
5.1.14	Motor of each type and rating	1 No	1 No
5.2	**Spares for Lubrication Water Pumps**		
5.2.1	Impeller with nuts and other accessories	1 set	1 set
5.2.2	Impeller Shaft with fasteners	1 set	1 set
5.2.3	Shaft Sleeves	1 set	1 set
5.2.4	Wearing rings – Impeller (if applicable)	1 set	1 set
5.2.5	Wearing Rings – Casing (if applicable)	1 set	1 set
5.2.6	Pump bearings	1 set	1 set
5.2.7	Thrust bearings	1 set	1 set

	DATA SHEET - A	SPECIFICATION NO.:	PE-TS-497-100-W001
	MISCELLANEOUS PUMPS (VERTICAL)	**REV. NO.: 00**	**DATE** : 06/09/2023
	2X660 MW TALCHER TPP	**SECTION:**	**I D**
Sl. No.	**DESCRIPTION**	**RAW WATER (PT) PUMPS**	**RAW WATER (ASH) PUMPS**
5.2.8	Pump & Drive Coupling compl. assy. & coupling Guards	1 set	1 set
5.2.9	Pump to drive coupling bushes with fasteners	1 set	1 set
5.2.10	Gland, Packing & Gland Assembly / Mech. seal as applicable	1 set	1 set
5.2.11	Motor for Lubrication Water Pumps	1 No	1 No
5.3	**C&I Spares**		
5.3.1	Transmitters of all types and model. (for the measurement of Pressure, differential pressure, flow, level, etc.) including local indication (if applicable)	2 Nos. of each type and model.	2 Nos. of each type and model.
5.3.2	Pressure gauges	1 no. of each range and type	1 no. of each range and type
5.3.3	Differential Pressure Gauges,	1 no. of each range and type	1 no. of each range and type
5.3.4	All types of Rota meters	1 no. of each range	1 no. of each range
5.3.5	Process Actuated Switch Devices -As applicable for this package, as per the following items		
5.3.5 (a)	Flow switches	1 no. of each range and type	1 no. of each range and type
5.3.5 (b)	Solenoid Valves	2 nos. of each type, model and rating.	2 nos. of each type, model and rating.

Mandatory Spare Note:

1. Wherever quantity has been specified as percentage (%), it shall mean percentage (%) of the total population of the item in the station (project), unless specified otherwise and the fraction will be rounded off to the next higher whole number.

2. Wherever the quantities have been indicated for each type, size, thickness, material, radius, range etc. these shall cover all the items supplied and installed and the break up for these shall be furnished in the bid.

3. In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed as above.

4. Each spare shall be clearly marked and labeled on the outside of the packing with its description. When more than one spare part is packed in single case, a general description of the contents shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification.

6.0	**Bid Evaluation**		
6.1	Bid evaluation rate	Rs. 4.30 Lacs/KW	Rs. 4.30 Lacs/KW
6.2	Maximum permissible efficiency for Bid evaluation		
6.2.1	Pump Efficiency	86	84
6.2.2	Motor Efficiency	95.4	95.4

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 x 60 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.
5	Design and Construction Features, criteria for motor rating selection, operating range etc shall be same as indicated for Horizontal pumps (CW make-up Pump) indicated in Datasheet-A for Misc Pumps (Horizontal).
6	Material of construction for Forced Water Lubrication Pumps shall be same as indicated for Horizontal pumps (CW make-up Pump) indicated in Datasheet-A for Misc Pumps (Horizontal).

1676260/2023/20230823

	DATA SHEET - A	SPECIFICATION NO.:	PE-TS-497-100-W001, Rev-0
	MISCELLANEOUS PUMPS (HORIZONTAL)	REV. NO.: 00	DATE : 05/09/2023
	TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW)	VOLUME : ---	SECTION : ID

Sl. No.	DESCRIPTION	DMCW TG AUX'S PUMPS	DMCW SG AUX'S PUMPS	ACW PUMPS	DM MAKE-UP PUMPS	BOILER FILL PUMPS	CONDENSATE TRANSFER PUMPS	CW MAKE UP PUMPS	SERVICE WATER PUMPS	HVAC MAKE UP PUMPS	APH/ ESP WASH PUMPS	GYPSUM WASH PUMPS
1.0	**SERVICE**											
1.1	Total no. of pumps for Project	6	4	6	3	2	2	3	3	2	2	2
1.2	No. of working & standby pumps	(2W+1S) per unit	(1W+1S) per unit	(2W+1S) per unit	(2W+1S) for Station	(1W+1S) for Station	1 W PER UNIT	(2W+1S) FOR STATION	(2W+1S) FOR STATION	(1W+1S) FOR STATION	(1W+1S) FOR STATION	(1W+1S) FOR STATION
1.3	Liquid Handled (ref. water analysis enclosed herein)	pH corrected DM Water	pH corrected DM Water	Clarified water	DM Water	DM Water	DM Water	Clarified water	Clarified water	Clarified water	Clarified water	Clarified water
1.4	Location (Indoor / Outdoor)	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor
1.5	Duty	Continuous	Continuous	Continuous	Continuous	Intermittent	Intermittent	Continuous	Continuous	Continuous	Intermittent	Continuous
1.6	No. of pumps working in parallel	2	-	2	2	-	2	2	2	-	-	-
1.7	Specific gravity	1	1	1	1	1	1	1	1	1	1	1
1.8	System design pressure (kg/sqcm), g	10	10	7.5	12	25	12	10	10	10	12	10
2.0	**DESIGN PARAMETERS**											
2.1	Design capacity each, M^3/hr	1000	1130	2041	100	200	250	1430	220	100	760	45
2.2	Total dynamic head (MWC)	35.5	41	15.5	70	145	65	10	55	75	85	22
2.3	Suction Pressure(MWC)	24	37	20	Flooded suction	Flooded suction	Flooded suction	Flooded suction	Flooded suction	Flooded suction	Flooded suction	Flooded suction
2.4	Design Temperature (°C)	60	60	60	60	60	60	60	60	60	60	60
2.5	Maximum permissible speed of pump (RPM)	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
2.6	Max. limit on shut off head Corresponding to pump TDH (MWC) at 51.5 Hz	Not to exceed 70 MWC	Not to exceed 60 MWC	Not to exceed 50 MWC	Not to exceed 110 MWC	Not to exceed 235 MWC	Not to exceed 110 MWC	Not to exceed 90 MWC	Not to exceed 90 MWC	Not to exceed 90 MWC	Not to exceed 114 MWC	Not to exceed 90 MWC
2.7	Operating range	---------------40-120% of design duty point flow---------------										
2.8	Motor rating	Continuous motor rating (at 50 deg C ambient) for all pumps shall be at least ten per cent (10%) above the maximum load demand of the driven equipment in the complete operating range (including run out condition) to take care of the system frequency/voltage variation.										
2.9	Permissible tolerance in rated capacity & TDH	no negative tolerance										
2.10	Permissible tolerance in efficiency at rated capacity(%)	no negative tolerance										
2.11	Performance/Design Standard	HIS / IS 5120										
3.0	**CONSTRUCTION FEATURES**											
3.1	Pump type	Horizontal centrifugal type Between Bearing Pump	Horizontal centrifugal type Between Bearing Pump	Horizontal centrifugal type Between Bearing Pump	Horizontal centrifugal type	Horizontal centrifugal type	Horizontal centrifugal type	Horizontal centrifugal type Between Bearing Pump	Horizontal centrifugal type	Horizontal centrifugal type	Horizontal centrifugal type Between Bearing Pump	Horizontal centrifugal type
3.2	Impeller type	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
3.3	Casing type	Horizontal axial split type	Horizontal axial split type	Horizontal axial split type	Horizontal axial/radial split type	Horizontal axial/ radial split/multistage type	Horizontal axial/ radial split type	Horizontal axial split type	Horizontal axial/ radial split type	Horizontal axial/ radial split type	Horizontal axial split type	Horizontal axial/ radial split type
3.4	Coupling type	Flexible type	Flexible type	Flexible type	Flexible type	Flexible type	Flexible type	Flexible type	Flexible type	Flexible type	Flexible type	Flexible type
3.5	Sealing arrangement	Gland packing initially & Mechanical seal finally after commisioning	Gland packing initially & Mechanical seal finally after commisioning	Gland packing	Gland packing initially & Mechanical seal finally after commisioning	Gland packing initially & Mechanical seal finally after commisioning	Gland packing initially & Mechanical seal finally after commisioning	Gland packing	Gland packing	Gland packing	Gland packing	Gland packing
3.6	Type of Lubrication	Grease/ self water	Grease/ self water	Grease/ self water	Grease/ self water	Grease/ self water	Grease/ self water	Grease/ self water	Grease/ self water	Grease/ self water	Grease/ self water	Grease/ self water
3.7	Pump characteristics	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable
3.8	Drain Plugs, vent, lifting lugs, priming connection	Required										
4.0	**MATERIALS OF CONSTRUCTION**											
4.1	Casing	ASTM A-351 CF8M	ASTM A-351 CF8M	2.5 % Ni CI to IS 210 Gr. FG 260.	ASTM A-351 CF8M	ASTM A-351 CF8M	ASTM A-351 CF8M	2.5 % Ni CI to IS 210 Gr. FG 260.	2.5 % Ni CI to IS 210 Gr. FG 260.	2.5 % Ni CI to IS 210 Gr. FG 260.	2.5 % Ni CI to IS 210 Gr. FG 260.	2.5 % Ni CI to IS 210 Gr. FG 260.
4.2	Impeller	ASTM – A351 – CF8M	ASTM – A351 – CF8M	Bronze to IS 318 Gr. I/II or SS 316/ ASTM A 351 CF8M	ASTM – A351 – CF8M	ASTM – A351 – CF8M	ASTM – A351 – CF8M	ASTM – A351 – CF8M	ASTM – A351 – CF8M	ASTM – A351 – CF8M	ASTM – A351 – CF8M	ASTM – A351 – CF8M
4.3	Shaft	SS-316	SS-316	EN-8 (BS-970)	SS-316	SS-316	SS-316	SS-410	SS-410	SS-410	SS-410	SS-410
4.4	Shaft Sleeves	SS-410	SS-410	SS-410	SS-410	SS-410	SS-410	SS-410 (Hardened)	SS-410 (Hardened)	SS-410 (Hardened)	SS-410 (Hardened)	SS-410 (Hardened)
4.5	Impeller Wearing rings	SS-316	SS-316	High leaded bronze to IS-318 Gr. V / SS 316 in case of SS impeller	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316
4.6	Wetted Fasteners	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316
4.6	Other Fasteners	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316
4.7	Gland/Seal Cover	SS-316	SS-316	2.5 % Ni CI to IS 210 Gr. FG 260	SS-316	SS-316	SS-316	2.5 % Ni CI to IS 210 Gr. FG 260	2.5 % Ni CI to IS 210 Gr. FG 260	2.5 % Ni CI to IS 210 Gr. FG 260	2.5 % Ni CI to IS 210 Gr. FG 260	2.5 % Ni CI to IS 210 Gr. FG 260
4.9	Lantern Ring	SS-316	SS-316	Bronze	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316
4.10	Mech. seal	Manufacturer standard	Manufacturer standard	Not applicable	Manufacturer standard	Manufacturer standard	Manufacturer standard	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
4.10	Gland Packing	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)
4.11	Base Plate	MS fabricated IS-2062 (min. thk.-12 mm) Epoxy Coated										
4.12	Stuffing Box	ASTM A-351 CF8M	ASTM A-351 CF8M	2.5% Ni CI to IS 210 Gr. FG 260	ASTM A-351 CF8M	ASTM A-351 CF8M	ASTM A-351 CF8M	2.5% Ni CI to IS 210 Gr. FG 260	2.5% Ni CI to IS 210 Gr. FG 260	2.5% Ni CI to IS 210 Gr. FG 260	2.5% Ni CI to IS 210 Gr. FG 260	2.5% Ni CI to IS 210 Gr. FG 260
4.13	Casing Wearing rings (If applicable)	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316
4.14	Coupling	Cast iron	Cast iron	Cast iron	Cast iron	Cast iron	Cast iron	Cast iron	Cast iron	Cast iron	Cast iron	Cast iron
4.15	Connecting Pipe material (for deciding counterflange material)	Carbon Steel as per IS:2062 E250 GR. B, Plates rolled & welded as per IS 3589	Carbon Steel as per IS:2062 E250 GR. B, Plates rolled & welded as per IS 3589	Carbon Steel as per IS:2062 E250 GR. B, Plates rolled & welded as per IS 3589	ASTM-A-312 TP 304, ERW	ASTM-A-312 TP 304, ERW	ASTM-A-312 TP 304, ERW	Carbon Steel as per IS:2062 E250 GR. B, Plates rolled & welded as per IS 3589	Carbon Steel as per IS:2062 E250 GR. B, Plates rolled & welded as per IS 3589	Carbon Steel as per IS:2062 E250 GR. B, Plates rolled & welded as per IS 3589	Carbon Steel as per IS:2062 E250 GR. B, Plates rolled & welded as per IS 3589	Carbon Steel as per IS:2062 E250 GR. B, Plates rolled & welded as per IS 3589
5.0	**MANDATORY SPARES**											
5.1	Pump shaft	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set
5.2	Bearings (comprising of Drive & Non-drive end)	2 sets	2 sets	2 sets	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set
5.3	Complete Coupling (Pump & Motor)	1 set	1 set	1 set	-	-	-	-	-	-	-	-
5.4	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards	-	-	-	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set
5.5	Mechanical seal (both DE and NDE) if applicable	2 sets	2 sets	2 sets	-	-	-	-	-	-	-	-
5.6	Shaft Sleeve (DE & NDE)	2 sets	2 sets	2 sets	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set
5.7	Impeller	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set
5.8	Impeller wear ring	2 sets	2 sets	2 sets	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set
5.9	Casing wear ring	2 sets	2 sets	2 sets	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set
5.10	Gland	-	-	-	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set
5.11	Gland Packing	-	-	-	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set
5.12	Gland Assembly	-	-	-	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set
5.13	Sleeve nuts & 'O' rings	2 sets	2 sets	2 sets	-	-	-	-	-	-	-	-
5.14	Thrust bearings (if applicable)	2 sets	2 sets	2 sets	-	-	-	-	-	-	-	-
5.15	Fasteners	1 set	1 set	1 set	-	-	-	-	-	-	-	-
5.16	Stuffing box	-	-	-	1 set	1 set	1 set	1 set	1 set	1 set	1 set	1 set
	LT Motors											
5.17	Motor	1 no.	-	1 no.	1 no.	1 no.	1 no.	1 no.	1 no.	1 no.	-	1 no.
5.18	Driving End & Non-Driving End Bearing	1 set of each type & size	-	1 set of each type & size	-	-	-	-	-	-	-	-
	C&I :MEASURING INSTRUMENTS											
5.19	RTD's	-	1 no. of each type	-	-	-	-	-	-	-	1 no. of each type	-

	DATA SHEET - A										SPECIFICATION NO.:	PE-TS-497-100-W001, Rev-0
	MISCELLANEOUS PUMPS (HORIZONTAL)										REV. NO.: 00	DATE : 05/09/2023
	TALCHER THERMAL POWER PROJECT STAGE-III (2X660 MW)										VOLUME : ---	SECTION : ID
Sl. No.	**DESCRIPTION**	**DMCW TG AUX'S PUMPS**	**DMCW SG AUX'S PUMPS**	**ACW PUMPS**	**DM MAKE-UP PUMPS**	**BOILER FILL PUMPS**	**CONDENSATE TRANSFER PUMPS**	**CW MAKE UP PUMPS**	**SERVICE WATER PUMPS**	**HVAC MAKE UP PUMPS**	**APH/ ESP WASH PUMPS**	**GYPSUM WASH PUMPS**
	Mandatory Spare Note: 1. In case if such items of spares indicated as “not applicable” by bidder in its offer, are found applicable at a later date during execution of the project, such items of spares are to be supplied within the ordered cost of the mandatory spares. 2. In respect of quantity mentioned as 'Set' means the total quantity of all the components/items used in particular equipment unless otherwise specified.											
6.0	**BID EVALUATION RATE**											
6.1	Bid evaluation rate	Rs. 4.30 Lacs/KW	Rs. 4.30 Lacs/KW	Rs. 4.30 Lacs/KW	Rs. 4.30 Lacs/KW	NA	NA	Rs. 4.30 Lacs/KW	Rs. 4.30 Lacs/KW	Rs. 4.30 Lacs/KW	NA	Rs. 4.30 Lacs/KW
6.2	Benchmark efficiency for Bid evaluation											
6.2.1	Pump Efficiency (%)	85	85	86	65	-	-	85	80	62	-	70
6.2.2	Motor Efficiency (%)	95.4	NA	95.2	93.3	-	-	94.3	93.9	93.4	-	88.2
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 DMCW TG and ACW pumps and all HT Motor Driven Pumps (wherever applicable), bidder shall provide flat surface with dimensions 60 MM x60 MM on bearing Housing for pump & motor for mounting vibration measuring block and a key slots of dimensions 30MM (L) X 15 MM (W) X 3 MM (D) on each pump/ motor 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.											

	TECHNICAL SPECIFICATIONS	SPECIFICATION NO.:	PE-TS-497-100-W001, Rev.0		
		VOLUME:	IIB	SECTION:	D1
	MISCELLANEOUS PUMPS	REV. NO.	0	DATE:	06.09.2023

A. DM WATER ANALYSIS:

Conductivity:	Less than 0.1 microS/cm
Total silica:	Less than 0.02 ppm
pH:	8.5 to 9.5

B. RAW WATER AND CLARIFIED WATER ANALYSIS:

Sl no	Constituents	As	Raw Water Analysis	Clarified Water Analysis
1	Calcium	CaCO3	80	120.5
2	Magnesium	CaCO3	35	35
3	Sodium	CaCO3	20	20
4	Potassium	CaCO3	5	5
5	Total Cations	CaCO3	140	180.5
6	HCO3	CaCO3	85	91.2
8	Chlorides	CaCO3	35	37.8
9	Sulphate	CaCO3	20	51.5
10	Total Anions	CaCO3	140	180.5
11	Silica (Reactive)	SiO2	25	20.8
12	Silica (Non-Reactive)	SiO2	5	5
13	Iron (Total)	Fe	0.5	0.3
14	pH Value	-	6.8-8.0	6.0 - 8.0
15	Turbidity	NTU	2000	10
16	Total Dissolved Solids	PPM	190	283.5
17	Temp	Deg C	20-35	20-35
18	KMnO4	PPM	2	2
19	TOC	PPM	5	5

SUB-SECTION - IIA

STANDARD TECHNICAL SPECIFICATION (MECHANICAL)

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

	TITLE:	SPECIFICATION NO. PES-179-07	
		VOLUME:	
	STANDARD TECHNICAL SPECIFICATION VERTICAL PUMPS	SECTION: IIA	
		REV. NO. 04	DATE: 01/07/2016
		SHEET 1 of 18	

1.00.00 GENERAL INFORMATION

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

1.02.0 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship, and shall be capable of performing the required duties in a manner acceptable to Engineer/Owner who will interpret the meaning of drawings and specifications and shall be entitled to reject any component or material, which in his judgement is not in full accordance herewith.

1.03.0 The omission of specific reference to any component/accessory necessary for the proper performance of Miscellaneous Pumps and drives shall not relieve the bidder of the responsibility of providing such facilities to complete the supply of equipment at quoted prices.

1.04.0 BHEL's / Customer's representative shall be given full access to the shop in which the equipment are being manufactured or tested and all test records shall be made available to him.

1.05.0 The equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and shipping release issued by BHEL/Customer.

2.00.00 CODES AND STANDARDS

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

2.01.01	IS-1710/1989:	Vertical Turbine Pumps for Clear, Cold and Fresh Water.
2.01.02	IS-5120/1977:	Technical requirements for Rotodynamic special purpose pumps.
2.01.03	IS-5639/1970:	Pumps for handling chemicals & corrosive liquids.
2.01.04	IS-5659/1970:	Pumps for process water.
2.01.05	IS-6536/1972:	Pumps for handling volatile liquids.
2.01.06	IS-9137/1978:	Code for acceptance tests for centrifugal, mixed flow and axial flow pumps- Class 'C'.

2.01.07	BS 5316	Acceptance tests for Centrifugal, mixed flow Part-I/1976 and axial flow pumps - Class 'C' Tests (ISO 2548/1973)
2.01.08	BS 5316	Acceptance tests for Centrifugal, mixed flow Part-II/1977 and axial flow pumps - Class 'B' Tests (ISO 3555/1977)
2.01.09	ANSI B 73.2M 1984	Vertical inline centrifugal pumps for chemical process
2.01.10	API-610/1989:	Centrifugal pumps for general refinery services.
2.01.11	HIS	Hydraulic Institute Standards, USA
2.01.12	PTC 8.2/1965:	Power Test Codes - Centrifugal pumps.
2.01.13	ASTM-1-165-55	Standard Methods for Liquid Penetration Inspection.

2.02.00 In case of any contradiction with the above standards and annexure, the stipulations in the annexure shall prevail and shall be binding on the bidder.

3.00.00 SCOPE OF SUPPLY & SERVICES:

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

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

3.03.00 Accessories:

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

3.03.01 Standard accessories:

a) LT Electric drives/motors (as applicable) with cable gland and lugs at motor end. (The bare HT drive motors and LT motors not in bidder's scope of supply, wherever required supplied as free issue by BHEL refer Cl. 5.08.00).

b) Pump motor coupling along with coupling guard.

c) Common base/sole plate for pumps and motor.

d) Thrust block assembly (Thrust pads, attachments) for transferring the pump thrust to concrete thrust block (concrete thrust block in purchaser scope), as per clause 5.23.00.

e) Thrust bearing temperature measurement devise to be provided.

f) Self contained lubrication system along with all internal piping, valves, fittings, specialties etc. as required.

g) Counter flanges for suction/ discharge nozzles along with fixing nuts, bolts and gaskets.

h) Anchor bolts, nuts, seating steel works, shims etc. as necessary for mounting the pump-motor unit on Civil foundations.

i) Suitable vent (with valves)/ lifting/ handling attachments for the pump/ motor/ accessories.

j) Suitable drain connections with isolating valves as applicable.

k) Supply of first fill of lubricants with toping requirements for one year of operation after commissioning and handing over of equipment.

l) Set of “Special” Tools & Tackles for Pumps and motors, if any.

m) Erection and commissioning spares, “on as required” basis.

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

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

3.04.00 Services included in Bidder’s Scope:

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

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

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

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

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

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

3.05.00 Works excluded from Bidder's Scope:

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

4.00.00 BID EVALUATION CRITERIA & LIQUIDATED DAMAGES FOR SHORTFALL:

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

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

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

Where Q = Rated capacity M^3/hr
H = Rated TDH, MWC
P = Pump Efficiency
M = Motor Efficiency.
S = Specific Gravity of fluid handled

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

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

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

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

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

4.03.00 Liquidated damages for shortfall in Guaranteed KW

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

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

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

5.00.00 TECHNICAL REQUIREMENTS:

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

5.02.00 The pumps shall be Electric motor driven.

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

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

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

5.06.00 No negative tolerance shall be permitted in efficiency at rated capacity.

5.07.00 The shut off head of pumps shall be more than pump rated TDH and percentage variation may vary depending on the specific speed of the pump as under:

i. 10-15% for pumps of specific speed up to 1000 US units,
ii. 15-20% for pumps of specific speed in the range of 1000 to 2000 US units,
iii. 20-40% for pumps of specific speed in the range of 2000 to 4000 US units,
iv. Above 50% for pumps of specific speed in the range of 4000 to 7000 US units.

5.08.00 All HT motors and those LT motors which are not in bidder's scope of supply: bare motors only, shall be supplied as free issue by BHEL through BHEL, based on ratings and TS (Torque - Speed) curve selected and furnished by the bidders along with their un-priced bid. The responsibility for satisfactory operation for combined performance of pumps & motors shall rest with the bidder only as if, the drive motors also have been supplied by the bidder.

Couplings, base plate, foundation bolts, any other fittings, etc. as required shall be supplied by the bidders only. BHEL shall supply one number of each type of drive motors (where drive motor is not in bidder's scope of supply) for shop testing of pumps with job motors. All other motors shall be dispatched by BHEL directly to project sites.

5.09.00 For all HT motor driven pumps, BHEL has envisaged vibration-monitoring system in their own scope. The bidder shall make provisions for mounting following on the pump/ pump shaft:

- Purchaser’s probes in both DE/NDE bearings of pumps
- Key slots on pump shaft and flat surface on bearing housing for mounting vibration measuring block with dimensions as specified in Data Sheet A.
- Other components as finalized during detailing.
- For mounting of above on the HT motors & specifically excluded LT motors, same shall be taken care by BHEL.

5.10.00 The pumps shall be capable of developing the required total head at rated capacity for continuous operation. The pumps shall operate satisfactorily at any point on the Q-H characteristic curve over a range of 0% to 130% capacity and shall be suitable for continuous operation between 30% to 130% capacity.

5.11.00 Selection of the pumps shall be such that the design point shall be met even with negative manufacturing tolerance.

5.12.00 The total head capacity curve shall be continuously rising towards the shut off, the pumps shall preferably be non-overloading type and stable.

5.13.00 The pumps shall be capable of running over the entire range of submergence/ NPSH requirement conditions required without any noise, vibration or cavitations.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

- 2X100 % duty self cleaning strainers of suitable size and mesh opening shall be installed on the common pump discharge and outlet shall be led to 1 no. 6 hrs. storage or min. 10 M3 capacity tank of carbon steel MOC, to be placed on roof of pump house .

- 2X100 % duty horizontal centrifugal lubricating pumps with TDH more than the shut off head of the subject pumps shall be provided. The capacity of each pump shall be sufficient to lubricate all of the subject pumps including 10% margin on capacity and head to suit requirement with 10 % margin with head.

- These horizontal pumps shall take suction from the overhead Sintex tank as explained above.

- Associated piping, fittings, Tank inlet motor operated valve, lubricating pumps suction & discharge isolating valves, motorised/ solenoid valves (as per purchaser's approval), lubricating pumps discharge check valves and lubricating pipe isolating valve at inlet to each of subject pump, etc. as required shall be provided.

- Instrumentation – Level Gauge, high level & low level switches for tank, pressure gauges at suction & discharge of each lubricating water pumps, low pressure switch on lubricating pipe at inlet to each of subject pump for subject pump start interlock, pressure switch on lubricating pipe at common discharge of subject pump for start up of stand by pump etc., as required subject to purchaser's approval shall be provided.

- Bidder shall supply any other equipment/ instrument required for proper functioning of the lubricating system, as deemed necessary during contract without any price implication to BHEL.

- Bidder shall also provide a relay based local control panel for proper functioning of the above system. The system shall be suitable for fully automatic operation as per approved write-up during detailed stage.

- Subject pumps shall be provided with shaft enclosing tube in the event above Lubrication system is envisaged by bidder. MOC for shaft enclosing tube shall be equivalent/ superior to MOC for column pipe for subject pump.

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

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

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

6.00.00 MANDATORY SPARES:

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

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

7.00.00 OTHER REQUIREMENTS:

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

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

	TITLE:	SPECIFICATION NO. PES-179-07	
		VOLUME:	
	STANDARD TECHNICAL SPECIFICATION VERTICAL PUMPS	SECTION: IIA	
		REV. NO. 04	DATE: 01/07/2016
		SHEET 10 of 18	

7.03.00 The makes of various bought out items of bidder (i.e. motor, bearings etc.) shall be subject to purchaser's approval in the event of order.

7.04.00 Painting for Pumps

a) The surface of SS, Gun metal, brass, bronze and non-metallic component shall not be applied with any painting.

b) The Steel surface to be applied with painting shall be thoroughly cleaned before applying painting by brushing, shop blasting etc. as per the agreed procedure.

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

d) For all the steel surfaces exposed to (outdoor installation) atmosphere, a coat of chlorinated rubber based zinc phosphate primer of min. thickness DFT of 50 microns followed up with under coat of chlorinated rubber paint of min. thickness DFT of 50 microns shall be applied. Then, intermediate coat consisting of one coat of chlorinated rubber based paint pigmented with Titanium di-oxide with min. thickness DFT of 50 microns and top coat shall consist of two coats each of min. thickness DFT of 50 microns of chlorinated rubber paint shall be provided. Total DFT of paint system shall be min. 200 microns.

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

8.00.00 **PERFORMANCE REQUIREMENTS**

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

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

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

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

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

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

9.00.00 **DESIGN AND CONSTRUCTION**

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

9.01.00 **Bowl Assembly**

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

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

9.02.00 **Discharge Head**

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

9.03.00 **Column pipe**

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

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

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

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

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

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

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

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

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

9.05.00 **Shaft enclosing tube**

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

9.06.00 **Seal rings**

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

9.07.00 **Bearings**

9.07.01 **Shaft bearings**

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

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

9.07.02 **Thrust Bearing**

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

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

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

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

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

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

9.08.00 **Reverse Rotation**

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

9.09.00 **Drive Unit**

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

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

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

b) 10% margin over the maximum pump shaft input power required within the ‘Range of Operation’.

c) Pump shaft input power required considering the overloading of the pump assuming

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

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

10.00.00 **INSPECTION AND TESTING**

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

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

a) **Identification and Testing**

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

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

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

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

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

- Shaft coupling & other active components shall be subjected to Dye Penetration and Ultrasonic Tests.

- Wearing rings, shaft sleeves shall be subjected to Dye Penetration Test.

- Fabricated components of pumps shall be subjected to Dye Penetration test on weld.

- Verification of material, witnessing of pouring, casting and inspection of finished fabricated/castings.

- Inspection of finished castings for impeller and verification of materials.

- Inspection of pump shaft and verification of material.

- Witnessing of NDT/review of NDT reports.

- Static balancing test for impeller and dynamic balancing of complete rotating parts as per ISO- 1940 to grade 6.3 or better.

- Complete Inspection of assembled pump.

b) **Hydraulic Testing**

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

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

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

c) **Performance Test at Shop**

i) Each pump shall have to be tested to determine the performance curves of the pumps. These tests are to be conducted in presence of Owner's representative as per the requirements of the Standards of Hydraulic Institute of USA (ASME-Power Test Code PTC 8.2/BS-599) or any other equivalent standard.

ii) Performance tests are to be conducted to cover the entire range of operation of the pumps at rated speed. These shall be carried out to span 130% of rated capacity up to pump shut-off condition. A minimum of five combinations of head and capacity are to be achieved during testing to establish the performance curves, including the design capacity point, shut-off point and the two extremities of the range of operation as specified in the annexure. After

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

iii) Tests shall be conducted with actual drive motors being furnished.

iv) Minimum submergence/ NPSH required tests are to be conducted for each type at 3% head drop conditions, if specified in the pump approved QP.

v) All rotating components of the pumps shall be subjected to static and dynamic balancing tests. The assembled rotor will be subjected to dynamic balancing tests.

vi) Mechanical run test shall be carried out on all pumps to determine the vibration levels, noise levels etc. This test shall be conducted at site also. However, test value at site shall be used for the acceptance of the equipment.

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

11.00.00 DRAWINGS/ DOCUMENTS DISTRIBUTION SCHEDULE

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

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

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

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

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

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

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

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

a) Compliance certificate duly signed and stamped (enclosed at Section-IIIB).

b) GA drawings of pumps and motors with following: (shall be only for reference purpose, same shall not be reviewed/commented by purchaser at this stage and shall be subject to approval only during contract).
- Civil static & dynamic loads.
- Foundation details.
- Minimum Submergence required.
- Clearances - Side, Back & Bottom
- Min. Recommended crane capacity

c) Guarantee Schedule duly signed and stamped (enclosed at Section-IIIA).

d) Technical deviation schedule (if reqd.) (enclosed at Section-IIIC).

e) Data for drive Motor (HT/LT- which is not in bidder's scope of supply - as applicable): Load torque speed curves of the pumps, selected motor rating, rpm, GD^2 of driven equipment.

f) Unpriced copy of the price bid shall be furnished along with the technical bid.

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

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

DATA SHEET – C

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

1.0 Drawings/documents submission schedule, shall be as per Section-IA.
The successful bidder shall submit at least following drawings/ documents:

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

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

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

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

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

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

1.6 Operation and maintenance manual.

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

1.8 PG test procedure as per clause 3.04.03 (if applicable).

1.9 Motor type test document (if applicable).

1.10 Test Procedure for Sump Model Study (if applicable).

2.0 Within the stipulated time period as per vendor's drawings/ documents schedule as per NIT, the O&M Manual comprising of minimum following shall be submitted:
a) Drawings of components & details as deemed necessary.
b) Instruction manual for erection, operation & maintenance.
c) Storage instruction.

3.0 Before dispatch of the equipment the bidder shall furnish the following.
a) Material test certificates.
b) Shop test reports & certificates.
c) Fulfilment of packing instructions as indicated in Section-IA of this specification.

4.0 Distribution of drawings / documents for all projects:

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

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

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.

e) Counter flanges for suction/ discharge nozzles along with fixing nuts, bolts and gaskets.

f) Anchor bolts, nuts, seating steel works, shims etc. as necessary for mounting the pump-motor unit on civil foundations.

g) Suitable vent (with valves)/ lifting/ handling attachments for the pump/ motor/ accessories.

h) Suitable drain connections with isolating valves as applicable.

i) Supply of first fill of lubricants with toping requirements for one year of operation after commissioning and handing over of equipment.

j) Set of “Special” Tools & Tackles for Pumps and motors, if any.

k) Erection and commissioning spares, “on as required” basis.

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

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

3.04.00 Services included in Bidder’s Scope:

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

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

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

3.04.04 After commissioning of pumps at site, site performance test for Noise, vibration and parallel running of pumps of all pumps for each unit/project shall be conducted by pump vendor at project site to ensure that the pumps meet the specified requirements. Pump vendor shall bring necessary instruments for conductance of site performance test.

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

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

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

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

3.05.00 Works excluded from Bidder's Scope:

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

4.00.00 BID EVALUATION CRITERIA & LIQUIDATED DAMAGES FOR SHORTFALL:

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

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

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

Where Q = Rated capacity M^3/hr
H = Rated TDH, MWC
P = Pump Efficiency
M = Motor Efficiency.
S = Specific Gravity of fluid handled

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

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

NOTE:

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

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

4.03.00 Liquidated damages for shortfall in Guaranteed KW

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

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

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

5.00.00 TECHNICAL REQUIREMENTS:

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

5.02.00 The pumps shall be Electric motor driven.

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

5.04.00 The horizontal pumps shall be Horizontal split casing type with speeds not exceeding 1500 RPM or as indicated in Data Sheet-A.

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

5.06.00 No negative tolerance shall be permitted in efficiency at rated capacity.

	TITLE:	SPECIFICATION NO. PES-179-06	
		VOLUME:	
	STANDARD TECHNICAL SPECIFICATION	SECTION: IIA	
	HORIZONTAL PUMPS	REV. NO. 04	DATE: 01/07/2016
		SHEET 6 of 16	

5.07.00 The shut off head of pumps shall be more than pump rated TDH and percentage variation may vary depending on the specific speed of the pump as under:

i. 10-15% for pumps of specific speed up to 1000 US units,
ii. 15-20% for pumps of specific speed in the range of 1000 to 2000 US units,
iii. 20-40% for pumps of specific speed in the range of 2000 to 4000 US units,
iv. Above 50% for pumps of specific speed in the range of 4000 to 7000 US units.

5.08.00 All HT motors and those LT motors which are not in bidder's scope of supply: bare motors only, shall be supplied as free issue by BHEL through BHEL, based on ratings and TS (Torque - Speed) curve selected and furnished by the bidders along with their un-priced bid. The responsibility for satisfactory operation for combined performance of pumps & motors shall rest with the bidder only as if, the drive motors also have been supplied by the bidder.

Couplings, base plate, foundation bolts, any other fittings, etc. as required shall be supplied by the bidders only. BHEL shall supply one number of each type of drive motors (where drive motor is not in bidder's scope of supply) for shop testing of pumps with job motors. All other motors shall be dispatched by BHEL directly to project sites.

5.09.00 For all HT motor driven pumps, BHEL has envisaged vibration-monitoring system in their own scope. The bidder shall make provisions for mounting following on the pump/ pump shaft:

- Purchaser’s probes in both DE/NDE bearings of pumps
- Key slots on pump shaft and flat surface on bearing housing for mounting vibration measuring block with dimensions as specified in Data Sheet A.
- Other components as finalized during detailing.
- For mounting of above on the HT motors & specifically excluded LT motors, same shall be taken care by BHEL.

5.10.00 The pumps shall be capable of developing the required total head at rated capacity for continuous operation. The pumps shall operate satisfactorily at any point on the Q-H characteristic curve over a range of 0% to 130% capacity and shall be suitable for continuous operation between 30% to 130% capacity.

5.11.00 Selection of the pumps shall be such that the design point shall be met even with negative manufacturing tolerance.

5.12.00 The total head capacity curve shall be continuously rising towards the shut off, the pumps shall preferably be non-overloading type and stable.

5.13.00 The pumps shall be capable of running over the entire range of NPSH conditions required without any noise, vibration or cavitations.

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

	TITLE:	SPECIFICATION NO. PES-179-06	
		VOLUME:	
	STANDARD TECHNICAL SPECIFICATION	SECTION: IIA	
	HORIZONTAL PUMPS	REV. NO. 04	DATE: 01/07/2016
		SHEET 7 of 16	

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.

	TITLE:	SPECIFICATION NO. PES-179-06	
		VOLUME:	
	STANDARD TECHNICAL SPECIFICATION HORIZONTAL PUMPS	SECTION: IIA	
		REV. NO. 04	DATE: 01/07/2016
		SHEET 8 of 16	

7.00.00 OTHER REQUIREMENTS:

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

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

7.03.00 The makes of various bought out items of bidder (i.e. motor, bearings, mechanical seal etc.) shall be subject to purchaser's approval in the event of order.

7.04.00 Painting for Pumps

a) The surface of SS, Gun metal, brass, bronze and non-metallic component shall not be applied with any painting.

b) The Steel surface to be applied with painting shall be thoroughly cleaned before applying painting by brushing, shop blasting etc. as per the agreed procedure.

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

d) For all the steel surfaces exposed to (outdoor installation) atmosphere, a coat of chlorinated rubber based zinc phosphate primer of min. thickness DFT of 50 microns followed up with under coat of chlorinated rubber paint of min. thickness DFT of 50 microns shall be applied. Then, intermediate coat consisting of one coat of chlorinated rubber based paint pigmented with Titanium di-oxide with min. thickness DFT of 50 microns and top coat shall consist of two coats each of min. thickness DFT of 50 microns of chlorinated rubber paint shall be provided. Total DFT of paint system shall be min. 200 microns.

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

	TITLE:	SPECIFICATION NO. PES-179-06	
		VOLUME:	
	STANDARD TECHNICAL SPECIFICATION HORIZONTAL PUMPS	SECTION: IIA	
		REV. NO. 04	DATE: 01/07/2016
		SHEET 9 of 16	

8.00.00 **PERFORMANCE REQUIREMENTS**

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

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

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

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

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

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

9.00.00 **DESIGN AND CONSTRUCTION**

9.01.00 **Pump Casing**

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

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

9.01.03 In case where an expansion joint is located at pump discharge, the pump assembly will be subjected to an additional thrust which will be transmitted to the foundation. This additional thrust shall be taken into the consideration of pump design.

9.02.00 **Impeller**

9.02.01 The Impeller assembly shall be dynamically balanced and designed with critical speed substantially above the operating speed.

	TITLE:	SPECIFICATION NO. PES-179-06	
		VOLUME:	
	STANDARD TECHNICAL SPECIFICATION HORIZONTAL PUMPS	SECTION: IIA	
		REV. NO. 04	DATE: 01/07/2016
		SHEET 10 of 16	

9.03.00 **Wearing Rings**

9.03.01 Replaceable type wearing rings shall be furnished to prevent damage to impeller and casing.

9.04.00 **Shaft**

9.04.01 Shaft size shall be selected considering that the critical speed shall be away from the operating speed as recommended in applicable Code/Standard. The critical speed shall be at least 30% higher than the rated speed.

9.05.00 **Shaft Sleeves**

9.05.01 Renewable type fine finished shaft sleeves shall be provided at the stuffing boxes/mechanical seals. Length of the shaft sleeves must extend beyond the other faces of gland packing or seal end plate so as to distinguish between the leakage past Shaft and shaft sleeve and that past the seals/glands.

9.05.02 Shaft sleeves shall be properly fastened to the shaft to prevent any leakage or loosening. Shaft sleeve assembly should ensure concentric rotation.

9.06.00 **Bearings**

9.06.01 Bearings shall be easily accessible without disturbing the pump assembly. A drain shall be provided at the bottom of each bearing housing.

9.06.02 Heavy-duty sleeve/ball/roller type bearings shall be provided to take care of the radial loads.

9.06.03 In case of sleeve type radial, axial thrust shall be absorbed in suitable hydraulic devices and/or thrust bearings.

9.06.04 Bearings and hydraulic devices (if provided for balancing axial thrust) shall be of adequate design for taking the entire pump load arising from all probable conditions of continuous operation. Life of the bearings shall be guided by the design standard of the pump. Antifriction bearings of standard type, if provided, shall be selected for a minimum life 20,000 hrs. of continuous operation at maximum axial and radial loads at rated speed. Thrust bearing shall be capable of running continuously at maximum load.

9.06.05 The bearing shall be oil/grease lubricated. Suitable lubricating arrangement for the bearings shall be furnished with the pump complete with all accessories like pump, filters, piping, fittings, valves, interlocking and supervising instruments etc. as necessary. The design shall be such that the bearing lubricant does not contaminate the liquid being pumped.

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

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.

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

b) 10% margin over the maximum pump shaft input power required within the 'Range of Operation'.

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

9.10.00 **Coupling for pump & Motor Shaft**

9.10.01 The pump and motor shafts shall be connected with adequately sized flexible coupling of proven design with spacer to facilitate dismantling of the pump without disturbing the motor. Necessary coupling guard shall be provided.

9.10.02 No. of coupling holes for joining coupling hubs shall be even in number and preferably in multiples of four.

10.00.00 **INSPECTION AND TESTING**

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

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

a) **Identification and Testing**

i) All materials used for pump construction shall be of tested quality. Material shall be tested as per the relevant standard and test certificates shall be made available to the Owner.

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

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

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

- Shaft coupling & other active components shall be subjected to Dye Penetration and Ultrasonic Tests.

- Wearing rings, shaft sleeves shall be subjected to Dye Penetration Test.

- Fabricated components of pumps shall be subjected to Dye Penetration test on weld.

- Verification of material, witnessing of pouring, casting and inspection of finished fabricated/castings.

- Inspection of finished castings for impeller and verification of materials.

- Inspection of pump shaft and verification of material.

- Witnessing of NDT/review of NDT reports.

- Static balancing test for impeller and dynamic balancing of complete rotating parts as per ISO- 1940 to grade 6.3 or better.

- Complete Inspection of assembled pump.

b) **Hydraulic Testing**

The pump casing shall be hydrostatically tested at maximum of the following:

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

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

c) **Performance Test at Shop**

i) Each pump shall have to be tested to determine the performance curves of the pumps. These tests are to be conducted in presence of Owner's representative as per the requirements of the Standards of Hydraulic Institute of USA (ASME-Power Test Code PTC 8.2/BS-599) or any other equivalent standard.

ii) Performance tests are to be conducted to cover the entire range of operation of the pumps at rated speed. These shall be carried out to span 130% of rated capacity up to pump shut-off condition. A minimum of five combinations of

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

iii) Tests shall be conducted with actual drive motors being furnished.

iv) NPSH tests are to be conducted for each type at 3% head drop conditions, if specified in the pump approved QP.

v) All rotating components of the pumps shall be subjected to static and dynamic balancing tests. The assembled rotor will be subjected to dynamic balancing tests.

vi) Mechanical run test shall be carried out on all pumps to determine the vibration levels, noise levels etc. This test shall be conducted at site also. However, test value at site shall be used for the acceptance of the equipment.

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

11.00.00 DRAWINGS/ DOCUMENTS DISTRIBUTION SCHEDULE

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

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

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

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

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

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

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

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

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

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

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

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

DATA SHEET – C

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

1.0 Drawings/documents submission schedule, shall be as per Section-IA.
The successful bidder shall submit at least following drawings/ documents:

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

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

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

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

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

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

1.6 Operation and maintenance manual.

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

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

1.9 Motor type test document (if applicable).

2.0 Within the stipulated time period as per vendor's drawings/ documents schedule as per NIT, the O&M Manual comprising of minimum following shall be submitted:
a) Drawings of components & details as deemed necessary.
b) Instruction manual for erection, operation & maintenance.
c) Storage instruction.

3.0 Before dispatch of the equipment the bidder shall furnish the following.
a) Material test certificates.
b) Shop test reports & certificates.
c) Fulfilment of packing instructions as indicated in Section-IA of this specification.

4.0 Distribution of drawings / documents for all projects:

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

	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 ** M	C	N	REMARKS
1	2	3	4	5	6 M C/N	7	8	9	* D	10			11
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	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	CORRELATION REQUIRED, IDENTIFICATION AS PER TC
		2.DIMENSIONS	CR	2.MEASURMENT	100%	MFR. DRAWING	MFR. DRAWING	INSP.REPORT	√	P	V	V	
		3.INTERNAL DEFECTS FOR 40MM & ABOVE DIA SHAFTS.	CR	3.ULTRA SONIC TEST	100%	ASTMA388 BACK WALL ECHO 100%	DEFECT ECHO MAX 20% OF B.W.E. LOSS OF BACK WALL ECHO 20% MAX	NDT CERTIFICATE	√	P	V	V	
1.4	STRESS RELIEVING/ HEAT TREATMENT OF CASTING OF ALL ABOVE (IF APPLICABLE) / SOLUTION ANNEALING OF SS CASTING	1. VARIFICATION 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./MAFG./ 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:	03/02/2020	TANUJ MATTA	Checked by:	03.02.20	MOHIT KUMAR	Seal		Reviewed by:			
Reviewed by:	3/2/20	AJAY JAIN	Reviewed by:	03/02/2020	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 2 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
					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	ISO1940 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					Doc No:			
	Sign & Date	Name		Sign & Date	Name	Sign & Date			Sign & Date	Name	Seal
Prepared by:	03/02/2020	TANUJ MATTA	Checked by:	03.02.20	MOHIT KUMAR	Seal		Reviewed by:			
Reviewed by:	3/2/20	AJAY JAIN	Reviewed by:	03/02/2020	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-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	* D	AGENCY ** M	C	N	REMARKS
1	2	3	4	5	6 M C/N	7	8	9		10			11
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:	03/02/2020	TANUJ MATTA	Checked by:	03.02.20	MOHIT KUMAR	Seal		Reviewed by:			
Reviewed by:	3/2/20	AJAY JAIN	Reviewed by:	03/02/2020	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	* D	AGENCY ** M	AGENCY ** C	AGENCY ** N	REMARKS
1	2	3	4	5	6	7	8	9		10			11
					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 QP 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 UNBALACE	STATIC & DYNAMIC	CR	STATIC & DYNAMIC BALANCING	100%	ISO 1940	ISO1940 Gr 6.3	BALANCING CERTIFICATE	√	P	W	V	WTNESSING ONLY FOR SIZE GREATER THAN 10KW
3.3	COMPLETE PUMP ASSEMBLY	COMPLETENESS, CORRECTNESS, CLEANLINESS, CLEARANCES, FREENESS, ALIGNMENT	MA	VISUAL EXAM MEASUREMENT	100%	APPROVED DRG & MFG STANDARDS	APPROVED DRG & MFG STANDARDS	I.R. & CHECK LISTS	√	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:	03/02/2020	TANUJ MATTA	Checked by:	03.02.20	MOHIT KUMAR	Seal		Reviewed by:			
Reviewed by:	3/2/20	AJAY JAIN	Reviewed by:	03/02/2020	RITESH KUMAR JAISWAL			Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC NO. PE-TS-XXX-109-N001	DATE	
BHEL		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 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
					M C/N								
4	FINAL INSPECTION, TESTS & PACKING DESPATCH CONTROL												
4.1	PUMP WITH JOB/SHOP MOTOR ASSEMBLED ON INDIVIDUAL BASE FRAME	1. Q V/S HEAD, 2. Q V/S POWER, 3. Q V/S PUMP EFF. 4. VIBRATION 5. NOISE 6. BEARING TEMP. 7. LEAKAGES	CR	PERFORMANCE TEST	100%	APPD. PERFORMANCE TEST PROCEDURE/ APPD. DATA SHEET/APPD. CURVES FOR VIBRATIONS - AS PER ANSI/HIS 9.6.4-2009 (VALUES AS PER APPROVED DATA SHEET) FOR BEARING TEMP - BEARING HOUSING SHOULD NOT BE UNTOUCHABLY HOT. FOR LEACKAGE - MINOR LEKAGE (DROP BY DROP) IN CASE OF GLAND PACKING ARRANGEMENT.		I.R., PERF. TEST RECORD, PLOTED 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, PLOTED CURVES	√	P	W	W	IF SPECIFIED or INSISTED BY CUSTOMER.
4.2	STRIP DOWN AFTER PERFORMANCE TEST	1UNDUE WEAR TEAR AND RUBBING	MA	VISUAL EXAM AFTER STRIPPING	1/MODEL	NO UNDUE WEAR 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 MEASURMENT	100%	APPD. G.A DRAWING	APPD. G.A DRAWING	INSP. REPORT	√	P	W	V	

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY					Doc No:			
	Sign & Date	Name		Sign & Date	Name	Sign & Date			Sign & Date	Name	Seal
Prepared by:	03/02/2020	TANUJ MATTA	Checked by:	03.02.20	MOHIT KUMAR	Seal		Reviewed by:			
Reviewed by:	3.2.20	AJAY JAIN	Reviewed by:	03/02/2020	RITESH KUMAR JAISWAL			Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC NO.: PE-TS-XXX-100-N001	DATE	
BHEL		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
										M	C	N	
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 MEASURMENT 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 MDCC

NOTES:

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

2. HYDRO TEST PRESSURE SHALL BE AT LEAST 2(TWO) TIMES THE DUTY POINT (OR) 1.S TIMES OF SHUT OFF HEAD (OR) SYSTEM DESIGN PRESSURE, WHICHEVER IS HIGHER.

3. THIS QAP IS ALSO APPLICABLE FOR SPARES.

4. NO WELD REPAIRS PERMISSIBLE ON CI CASTING.

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

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

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

8. BHEL RESERVES THE RIGHT FOR CONDUCTING REPEAT TEST IF REQUIRED.

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.

LEGEND : - * RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
** **M**: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **C**: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **N:** CUSTOMER
P- PERFORM, **W**- WITNESS, **V**-VERIFICATION, AS APPROPRIATE
MA: MAJOR, **MI**: MINOR, **CR**: CRITICAL, **MTC** -Mill Test Certificate, **TC**-Test Certificate, **IGC**- Inter Granular Corrosion.
GA -GENERAL ARRANGEMENT DRAWING, **CS**-CROSS-SECTIONAL DRAWING

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:	03/02/2020	TANUJ MATTA	Checked by:	03.02.20	MOHIT KUMAR	Seal		Reviewed by:			
Reviewed by:	3/2/20	AJAY JAIN	Reviewed by:	03/02/2020	RITESH KUMAR JAISWAL			Approved by:			

SUB-SECTION - IIB

STANDARD TECHNICAL SPECIFICATION (ELECTRICAL)

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	D	M	C	N	
					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 *	-	* NOTE -1
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	-	APPROVED DRG/ DATA SHEET	APPROVED DRG/ DATA SHEET	TEST/ INSPN. REPORT	✓	P	V *	-	* NOTE -1 & NOTE-2

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	HEMA KUSHWAHA	HEMA KUSHWAHA	Checked by:	Kunal Gandhi	KUNAL GANDHI		
Reviewed by:	PRAVEEN DUTTA	PRAVEEN DUTTA	Reviewed by:	RITESH KUMAR JAISWAL	RITESH KUMAR JAISWAL		

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

	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, INDENTIFIED 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					
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:			

1676260/2023/20230823

ENDORSEMENT SHEET FOR QP

REFERENCE / *STANDARD* / FIELD QUALITY PLAN (RQP / ~~SQP/RFQP/SFQP~~)

TO BE FILLED IN BY SUPPLIER AT TIME OF SUBMISSION		To be filled in by NTPC
PROJECT NAME		***REVIEW & ENDORSEMENT BY NTPC*** **PROJECT SPECIFIC QP NUMBER ALLOTTED**
CONTRACT NO.:	9915	**QP NO.:** 9915-371-110-PEM-QVE-Q-160
MAIN SUPPLIER	**BHARAT HEAVY ELECTRICAL LIMITED**	**REV. NO.:** 00 **DATE:** 03.12.2021
MANUFACTURER WORKS & ADDRESS		** The **RQP/~~SQP/RFQP/SFQP~~** once endorsed for a particular contract shall remain valid even though the original QP may have expired or revised, unless / otherwise mutually agreed with the supplier. ①
ITEM /EQUIPMENT / SYSTEM/ SUB-SYSTEM DETAILS i.e. MODEL TYPE / SIZE /RATING etc.	**MOTOR FOR CONDENSATE TRANSFER PUMP – 55 KW / 4 PL HORIZONTAL (2 NOS.)**	
APPROVED QP NO.: RQP/~~SQP/RFQP/SFQP~~	**000-999-QVE-P-44 REV-04 DTD 20 – 06 - 2012**	
Confirmation by Main Supplier (TICK WHICHEVER APPLICABLE)		*(TICK APPLICABLE)*
√I. That the item/ component is identical to that considered for QP approval. **OR.**		**The QP is endorsed for this project without any change** ✓
II. That there are minor changes in the item/ component with respect to that considered for QP approval, however the same do not affect the contents of QP. **OR**		
III. That there are minor changes in the item/ component with respect to that considered for QP approval, however the same affect the QP slightly, as indicated below / in attached sheet.		**The QP is endorsed for this project with changes as indicated.**
.		***DISTRIBUTION OF ENDORSEMENT OF*** **A) RQP/SQP:** ***1. MAIN SUPPLIER (WITH A COPY OF QP)*** ***2. MANUFACTURER*** ***3. RIO*** ***4. CQA-SPL*** ***5. CQA-O/C*** **B) RFQP/SFQP:** ***1. MAIN SUPPLIER (with a copy of QP)*** ***2. MANUFACTURER*** ***3. NTPC FQA (with a copy of QP)*** ***4. NTPC Erection (with a copy of QP)*** ***5. CQA-SPL*** ***6. CQA-O/C***

Mohit Kumar

Digitally signed by Mohit Kumar
DN: cn=Mohit Kumar, o=PEM, ou=BHEL, email=mohitk@bhel.in, c=IN
Date: 2021.12.03 12:03:02 +05'30'

RITESH KUMAR JAISWAL

Digitally signed by RITESH KUMAR JAISWAL
DN: c=IN, o=BHARAT HEAVY ELECTRICALS LIMITED, ou=POWER SECTOR-PROJECT ENGINEERING MANAGEMENT (PS-PEM), postalCode=201301, st=UTTAR PRADESH, 2.5.4.20=16692a281523bf78b46a8e18c5cd0bb189777532609b5349ee8d7191a9e51174, pseudonym=FA07E4CDEC357D8D213433A2A76385AD8F1F58ED, serialNumber=8CFADDF00184875A8803A31B000E93FF205304F62C650E6D5F9D99B0E098C448, cn=RITESH KUMAR JAISWAL
Date: 2021.12.03 12:40:10 +05'30'

1676260/2023/20230823

REFERENCE QUALITY PLAN

NTPC

To be filled in by NTPC

Item /equipment :
LT INDUCTION MOTORS (50KW TO 200 KW)
sub-system :

QP No.: NTPC-RQP 1
Rev. No.:'4'
Date:-
PAGE : Page 1 of 5

SIGN OF MANUFACTURER
MIQ

QP No.: 0000-999-QVE-P-044
Rev. No.: 4
Date :-20-6-12

Reviewed by:
V SHRIVASTAV
RAJIV GARG
P K BASU

Approved By:
अनुमोदित
Approved
AK GARG.....

Valid upto:19-06-15

Sr. No.	ITEM	Characteristics	Class	Type of Check	Quantum of check M	Quantum of check C/N	Reference Documents	Acceptance Norms	Format of Record	Agency D*	Agency M	Agency C	Agency N	Remarks
1	2	3	4	5	6		7	8	9	10				11
A. INCOMING INSPECTION: RAW MATERIAL / COMPONENT														
1	COPPER WIRE dual coated enameled round copper wire	1.Dimension	MA	Measurement	1 Sample / lot	1 Sample/lot	MSA-091-02-R0	MSA-091-02R0	Inspn. Record		P	V	--	
		2.Elongation	MA	Mechanical	-do-	-do-	-do-	-do-	-do-		P	V	--	
		3.Mandrel Winding Test	MA	Visual	-do-	-do-	-do-	-do-	-do-		P	V	--	
		4.Peel Test	MA	Test	-do-	-do-	-do-	-do-	-do-		P	V	--	
		5.BD Voltage Test	CR	Electrical	-do-	-do-	-do-	-do-	-do-		P	V	V	
		6.Cut Through Test	MA	Electrical	-do-	-do-	-do-	-do-	-do-		P	V	--	
		7.Heat Shock Test	MA	Test	-do-	-do-	-do-	-do-	-do-		P	V	--	
		8.Resistance	MA	Electrical	-do-	-do-	-do-	-do-	-do-		P	V	--	
		9.Springiness	MA	Mechanical	-do-	-do-	-do-	-do-	-do-		P	V	--	
		10.Abrasion Test	MA	Performance	-do-	-do-	-do-	-do-	-do-		P	V	--	
		11.Continuity Test	MI	Electrical	-do-	-do-	-do-	-do-	-do-		P	V	--	
		12.Tan Delta bending Point test	MA	Thermal	Each supplier once a month	-do-	-do-	-do-	-do-		V	V	V	
2	STEEL SHAFT Straightened steel bar in black finish	1.Dimension – OD	MA	Measurement	1 Sample/lot/heat	-do-	MSA-072-01R0	MSA-072-01R0	Supp. TC	√	V	V	--	
		2.Hardness	MA	Measurement	1 Sample/lot/heat	-do-	-do-	-do-	-do-	√	V	V	--	
		3.Chemical comp.	MI	Chemical	1 Sample/lot/heat	-do-	-do-	-do-	-do-	√	V	V	V	
		4.Tensile strength	MA	Mechanical	1 Sample/lot/heat	-do-	-do-	-do-	-do-	√	V	V	V	
		5.Yield strength	MA	Mechanical	1 Sample/lot/heat	-do-	-do-	-do-	-do-	√	V	V	--	
		6.% Elongation	MA	Mechanical	1 Sample/lot/heat	-do-	-do-	-do-	-do-	√	V	V	--	
		7.Ultrasonic test	MA	Mechanical	100%	-do-	-do-	-do-	-do-	√	V	V	V	
		8.Metallographic test	MA	Chemical	1 Sample/lot/heat	-do-	-do-	-do-	-do-	√	V	V	V	
		9 Normalizing	MA	Mechanical	100%	-do-	-do-	-do-	-do-	√	V	V	V	
3	AL INGOTS EC GRADE PURITY 99.5%	Chem. Comp.	MA		1 Sample/Lot	--	IS4026:1992	IS4026:1992	Supp. TC		V	--	--	

LEGENDS:* RECORDS IDENTIFIED WITH " TICK" ✓ SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION **
M: MANUFACTURER/ SUB-SUPPLIER C: MAIN SUPPLIER, N : NTPC, P: PERFORM, W : WITNESS, V: VERIFICATION.
AS APPROPRIATE CHP: NTPC SHALL BE INDICATED IN COLUMN 'N' AS 'W'

Note:# *NTPC Inspection Engineer to check, approval date/ revision no. of reference documents at the time of Inspection*

1676260/2023/20230823

REFERENCE QUALITY PLAN

NTPC

To be filled in by NTPC

Item /equipment : LT INDUCTION MOTORS (50KW TO 200 KW)	QP No.: NTPC-RQP 1 Rev. No.:'4' Date:- PAGE : Page 2 of 5	SIGN OF MANUFACTURER MiQ	QP No.: 0000-999-QVE-P-044 Rev. No.: 4 Date :-20-6-12 Valid upto:19-06-15
sub-system :			Reviewed by: V SHRIVASTAV, RAJIV GARG, P K BASU

Approved By: A K GARG

Sr. No.	ITEM	Characteristics	Class	Type of Check	Quantum of check M	Quantum of check C/N	Reference Documents	Acceptance Norms	Format of Record	Agency D*	Agency M	Agency C	Agency N	Remarks
1	2	3	4	5	6		7	8	9	10				11
A. INCOMING INSPECTION: RAW MATERIAL / COMPONENT														
4	CI CASTING (Body, End Shields, T.Box, Bearing Covers)	1.Surface defects	MA	Visual	100%	100%	MSA-02-01	No defect	Inspn. Rec		P	V	--	
		2.Dimn. Conformity	MA	Measurement	1 Sample / heat	--	Comp. Drg.	Comp. Drg.	-do-		P	--	--	
		3.Hardness	MA	Mechanical	1 Sample / lot	1 Sample / lot	IS 210:1993	IS 210:1993	Supp. TC		V	V	--	
		4.Tensile strength	MA	Verification	-do-	-do-	-do-	-do-	-do-		V	V	--	
		5.Chemical comp.	MA	Verification	-do-	-do-	-do-	-do-	-do-		V	V	--	
5	ALUMINUM FAN	1.Dimension	MA	Measurement	1Sample/size/lot	--	Fan Drg.	Fan Drg.	Inspn Rec.		P	--	--	
		2.Protective paint	MA	Visual	-do-	--	-do-	-do-	-do-		P	--	--	
6	VARNISH & THINNER	1.Viscosity	MA	Ford cup	1 Sample/ lot	--	MFGR's	MFGR's	Inspn. Rec.		v	--	--	
		2.Shelf life	MA	Verification	-do-	--	Catalogue	Catalogue	Label		v	--	--	
7	Bearing	ID / OD / WIDTH	MA	Measurement	1 Sample / lot	--	MFGR's Catalogue	MFGR's Catalogue	Inspn. Rec.	√	V	--	--	Surveillance verification By NTPC
8	BRAZING ALLOYS	Chemical comp.	MA	Chemical	1 Sample / lot	--	MSA-203-01R0	MSA-203-01R0	-do-		V	--	--	
9	TERMINAL BLOCK (DMC)	1.Dimension	MA	Measurement	1 Sample / lot	--	As per drg	As per drg	Supp. TC		P	--	--	
		2.Chem. Comp.	MA	Chemical	-do-	1 Sample / lot	-do-	-do-	-do-		V	--	--	
		3.Comparative Tracking Index	MA	Electrical	-do-	--	MSA-086-01	MSA-086-01			V	V	--	
10	PAINT	Viscosity at 32 Deg C	MA	Measurement	-do-		MFGR's Catalogue	MFGR's Catalogue	Inspn. Record		P	--	--	
11	SPACE HEATER	1.IR value & HV	MA	Electrical	100%	1sample/Rating/lot	MSA-023-01R0	MSA-023-02R0	Inspn Report		P	--	-	
		2.Resistance	MA	-do-	100%	-do-	-do-	-do-	-do-		P	--	-	
12	STAMPINGS	1.Thickness	MA	Measurement	1 Sample / lot	-do-	Stamping.drg.	Comp. drg.	Supp.TC		V	V	V	
		2.Waviness	MA	Visual	-do-	-do-	MSA-060-01R0	MSA-060-01R0	-do-		V	V	V	
		3.Burr height	MA	Measurement	-do-	-do-	-do-	<50 micron.	-do-		V	V	V	
		4.Coating Thickness	MA	Mechanical	-do-	-do-	-do-	MSA-060-01	-do-		V	V	V	
		5.Permeability	MA	Electrical	-do-	-do-	-do-	-do-	-do-		V	V	V	
		6.Specific core loss	MA	Electrical	-do-	-do-	-do-	-do-	-do-		V	V	V	
		7.IR	MA	Electrical	-do-	-do-	-do-	-do-	-do-		V	V	V-	

LEGENDS:* RECORDS IDENTIFIED WITH " TICK" ✓ SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION ** M: MANUFACTURER/ SUB-SUPPLIER C: MAIN SUPPLIER, N : NTPC, P: PERFORM, W : WITNESS, V: VERIFICATION. AS APPROPRIATE CHP: NTPC SHALL BE INDICATED IN COLUMN 'N' AS 'W'

Note:# NTPC Inspection Engineer to check, approval date/ revision no. of reference documents at the time of Inspection

1676260/2023/20230823

REFERENCE QUALITY PLAN

Item /equipment : LT INDUCTION MOTORS (50KW TO 200 KW)	QP No.: NTPC-RQP 1 Rev. No.:'4' Date:- PAGE : Page 3 of 5	SIGN OF MANUFACTURER MiQ	QP No.: 0000-999-QVE-P-044 Rev. No.: 4 Date :-20-6-12 Valid upto:19-06-15
sub-system :			

To be filled in by NTPC

Reviewed by: V SHRIVASTAV, RAJIV GARG, P K BASU

Approved By: AK GARG

Sr. No.	ITEM	Characteristics	Class	Type of Check	Quantum of check M	Quantum of check C/N	Reference Documents	Acceptance Norms	Format of Record	Agency D*	Agency M	Agency C	Agency N	Remarks
1	2	3	4	5	6		7	8	9	10				11
13	STATOR CORE PACK	1.Dimn. Conformity (core length. & Dia.)	MA	Measurement	1 Sample / lot	--	MSA-060-02R0	MSA-060-02R0	Inspn. Report		P	--	--	
		2.Alignment of slot	MA	Visual	-do-	--	-do-	-do-	-do-		P	--	--	
		3.Deburring and cleanliness	MA	Visual	-do-	--	-do-	-do-	-do-		P	--	--	
14	SLOT INSULATION (Class 'F')	1.Tensile Strength	MA	Mechanical	1 Sample/lot	--	MSA-088-09R0	MSA-088-09R0	Supp.TC		V	--	--	
		2.Elongation at break	MA	-do-	-do-	--	-do-	-do-	-do-		V	--	--	
		3.BDV as recd. & after ageing	CR	Electrical	-do-	1 Sample / lot	-do-	-do-	-do-		V	V	--	
		4.IR Value	MA	Electrical	-do-	--	-do-	-do-	-do-		V	--	--	
15	VARNISH FG SLEEVE (Class 'F')	1.Dimn. - Bore dia Thickness	MA	Measurement	1 Sample/lot	--	MSA-088-07R0	MSA-088-07R0	Supp.TC		P	--	--	
		2.BDV as recd. &after ageing	CR	Electrical	-do-		-do-	-do-	-do-		P	--	--	
		3.IRValue	MA	-do-	-do-		-do-	-do-	-do-		P	--	--	
		4. Glass content conformity	MA	Chemical	1 Sample/lot	--	MSA-088-07R0	MSA-088-07R0	Supp. TC		V	--	--	
		5. Varnish compatibility	MA	Chemical	-do-	--	-do-	-do-	-do-		V	--	--	
		6. Bending before and after aging	MA	Mechanical	-do-	--	-do-	-do-	-do-		V	--	--	
		7. Voltage proof test in air at room temp & at 150C	MA	Electrical	-do-	--	-do-	-do-	-do-		V	--	--	
		8. Stability of coating	MA	Chemical	-do-	--	-do-	-do-	-do-		V	--	--	
		9. Self extinguishing	MA	Chemical	-do-	--	-do-	-do-	-do-		V	--	--	
16	GASKET	1.Shore hardness	MA	Mechanical	1 Sample/lot	--	MSA 162-01R0	MSA 162-01R0	Inspn Record		P	--	--	
		2.Ageing test	MA	Thermal	-do-	--	-do-	-do-	Supp.TC		V	--	--	
		3.Flame test	MA	Chemical	-do-	1 Sample / lot	-do-	-do-	-do-		V	V	V	
		4.Neoprene conformity	MA	Chemical	-do-	-do-	-do-	-do-	-do-		V	V	V	
		5.Dimn.	MA	Mechanical	1 Sample /lot	--	Gasket Drg	Gasket Drg	Inspn Record		P	--	--	

LEGENDS:* RECORDS IDENTIFIED WITH " TICK" ✓ SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION ** M: MANUFACTURER/ SUB-SUPPLIER C: MAIN SUPPLIER, N : NTPC, P: PERFORM, W : WITNESS, V: VERIFICATION. AS APPROPRIATE CHP: NTPC SHALL BE INDICATED IN COLUMN 'N' AS 'W'

Note:# NTPC Inspection Engineer to check, approval date/ revision no. of reference documents at the time of Inspection

1676260/2023/20230823

REFERENCE QUALITY PLAN

Item /equipment : LT INDUCTION MOTORS (50KW TO 200 KW)	QP No.: NTPC-RQP 1 Rev. No.:'4' Date:- PAGE : Page 4 of 5	SIGN OF MANUFACTURER MiQ
sub-system :		

NTPC — To be filled in by NTPC

QP No.: 0000-999-QVE-P-044 Rev. No.: 4 Date :-20-6-12 *Valid upto:19-06-15*

Reviewed by: V SHRIVASTAV, RAJIV GARG, P K BASU

Approved By: AK GARG

Quality Assurance * N.T.P.C. * अनुमोदित Approved

Sr. No.	ITEM	Characteristics	Class	Type of Check	Quantum Of check M	Quantum Of check C/N	Reference Documents	Acceptance Norms	Format of Record	Agency D*	Agency M	Agency C	Agency N	Remarks
1	2	3	4	5	6		7	8	9	10				11
B	IN PROCESS INSPN. :													
1	MACHINED CASTINGS (BODY, END SHIELDS, T.BOX, BEARING Covers	1.Dimn.	CR	Measurement	100%		Comp.Drg.	Comp.Drg.	Inspn Record		P	--	--	No blow -holes on machined surface of castings & no welding on casting permitted
		2.Concentricity/ Perpendicularity of machined surface	MA	Mechanical	10%		-do-	-do-	-do-		P	--	--	
		3.Blow holes	MA	Visual	100%	--	No blow hole	No blowhole	-do-		P	--	--	
		4 .Pressure testing [4] (For Flameproof Motors only)	MA	Mechanical	100%	100%	MSA-02-02R0	MSA-02-02R0	Inspn Record		P	V	V	
2	COIL FORMING	1. Conductor dia	MA	Measurement	100%	--	Winding MO.	Winding MO.	-do-		P	--	--	
		2. No. of turns	MA	Visual	100%		-do-	-do-	-do-		P			
3	WOUND STATOR	1.Resistance	MA	Electrical	100%	--	-do-	-do-	-do-		P	--	--	
		2.HV Test	MA	-do-	-do-	--	-do-	-do-	-do-		P	--	--	
		3.Interturn (Surge Test)	MA	-do-	-do-	--	-do-	-do-	-do-		P	--	--	
		4.Polarity	MA	-do-	-do-	--	-do-	-do-	-do-		P	--	--	
		5. Impregnation : VPI	MA	Mechanical	100%	1/RATING/LOT	SP05	SP05	Inspn. Record		P	V	V	
		6.Workmanship (joints, Slot Wedges, tightness & connections)	MA	Visual	100%	--	-do-	-do-	-do-		P	--	--	
4	MACHINED SHAFT	1.Dimn.Conformity	CR	Mechanical	100%	--	Shaft Drg.	Shaft Drg.	Inspn. Record		P		--	
		2.Concentricity of Shaft	MA	-do-	-do-	--	-do-	-do-	-do-		P	--	--	
		3.M/cing finish, radius, chamfer	MA	Visual	-do-	--	-do-	-do-	-do-		P	--	--	
5	DIE CAST ROTOR	1. Core length	MA	Measurement	100%	--	M.O.	M.O.	Inspn. Record		P		--	
		2.Free from blow-holes, cracks	MA	Visual	100%	--	-do-	-do-	-do-		P	--	--	
6	MACHINED ROTOR	1.Dimn. - OD	CR	Measurement	100%	1 Sample / lot	-do-	-do-	Inspn. Record		P	--	--	
		2.Concentricity w.r.t. Bearing seat	MA	Mechanical	10%	-do-	-do-	-do-	-do-		P	--	--	
7	ROTOR	Dynamic balancing of Rotors at rated speed . [4]	MA	Mechanical	100%	100 %	A18 R0 & TS A16 R1	ISO: 1940 Grade- G 2.5	Inspn. Record	√	P	V	V	
8	FAN	Fan Balancing	MA	Mechanical	100%	100%	TS-A19-R0	ISO: 1940 Grade -G2.5	Inspn.Record	√	P	V	V	
9	ASSEMBLED MOTOR	Name Plate data, T. box location,	MA	Visual	100%	1 Sample / lot	TS: A20R5	TS: A20 R5	Inspn. Record		P	V	V	
		Flame path joint Gap for Flame proof motors [4]	MA	Mechanical	100%	100%	IS2148	IS2148	Inspn. Record		P	V	V	

LEGENDS:* RECORDS IDENTIFIED WITH * TICK' SH / LL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION **
M: MANUFACTURER/ SUB-SUPPLIER C: MAIN SUPPLIER, N: NTPC, P: PERFORM, W: WITNESS, V: VERIFICATION
AS APPROPRIATE CHP: NTPC SHALL BE INDICATED IN COLUMN 'N' AS 'W'

Note:# NTPC Inspection Engineer to check, approval date/ revision no. of reference documents at the time of Inspection

1676260/2023/20230823

REFERENCE QUALITY PLAN

NTPC

To be filled in by NTPC

Item /equipment : LT INDUCTION MOTORS (50KW TO 200 KW)	QP No.: NTPC-RQP 1 Rev. No.:'4' Date:- PAGE : Page 5 of 5	SIGN OF MANUFACTURER MiQ
sub-system :		

QP No.: 0000-999-QVE-P-044 Rev. No.: 4 Date :-20-6-12

Valid upto:19-06-15

Reviewed by: V SHRIVASTAV, RAJIV GARG, P K BASU

Approved By: AK GARG

Sr. No.	ITEM	Characteristics	Class	Type of Check	Quantum of check M	Quantum of check C/N	Reference Documents	Acceptance Norms	Format of Record	Agency D*	Agency M	Agency C	Agency N	Remarks
1	2	3	4	5	6		7	8	9	10				11
		VERIFICATION OF TYPE TEST CLEARANCE FROM NTPC ENGG												
C.	FINAL INSPECTION:	1. Marking on the Name Plate	MA	Visual	100%	100%	IS:325/ NTPC Specn/	IS:325/ NTPC Specn/	TC	√	P	W	W	
	ROUTINE TEST	2. a) Paint Shade	MA	Mechanical	-do-	-do-	Appd D/S,&Drg	Appd D/S,&Drg	TC	√	P	W	W	
		b) Paint Thickness (On casting surface)	MA	Mechanical	1 sample /Lot	1 sample /Lot	-do-	Min 100 microns	TC	√	P	W	W	
		c) Scratch Test	MA	Mechanical	-do-	-do-	-do-	No Peel-off						
		3.Location of T.Box.	MA	Visual	100%	100%	Appd D/S	Appd D/S	TC	√	P	W	W	
		4.IR test before & after HV on Main wdg. & Sp.Heater.	MA	Electrical	-do-	-do-	IS-325	IS-325	TC	√	P	W	W	
		5.HV on Main Wdg. & Space Heaters	MA	-do-	-do-	-do-	-do-	-do-	TC	√	P	W	W	
		6.Measurement of Wdg. Res.	MA	-do-	-do-	-do-	-do-	CGL-TS-35	TC	√	P	W	W	
		7.No Load Test	MA	-do-	-do-	-do-	-do-	Appd D/S,&Drg	TC	√	P	W	W	
		8.Locked Rotor Test at reduced voltage	MA	-do-	-do-	-do-	-do-	CGL-TS-35	TC	√	P	W	W	
		9.Reduced voltage running in both directions (1/^3 Un)	MA	-do-	-do-	-do-	-do-	IS325	TC	√	P	W	W	
		10.Overspeed test (120% of rated speed) for 2 min.	MA	Mechanical	-do-	-do-	-do-	-do-	TC	√	P	W	W	
		11. Vibration Test at rated speed & voltage	MA	Mechanical	-do-	-do-	IS12075	IS12075	TC	√	P	W	W	
		12.Degree of Protection By insertion of 1 mm thick wire	MA	Mechanical	-do-	-do-	-do-	IS:325/IS:4029	TC	√	P	W	W	
		13.Mounting & overall dimension	MA	Measurement	-do-	1Sample/rating/Lot	-do-	As per D/S & Drg	TC	√	P	W	W	
D.	DISPATCH INSPECT-IONS	Case Marking.	MA	Visual	100%	--	Manufacturing Order	Manufacturing Order	Manufacturing Order		P	--	--	

LEGENDS:* RECORDS IDENTIFIED WITH " TICK" ✓ SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION ** M: MANUFACTURER/ SUB-SUPPLIER C: MAIN SUPPLIER, N : NTPC, P: PERFORM, W : WITNESS, V: VERIFICATION, AS APPROPRIATE CHP: NTPC SHALL BE INDICATED IN COLUMN 'N' AS 'W'

Note:# NTPC Inspection Engineer to check, approval date/ revision no. of reference documents at the time of inspection

CLAUSE NO.

QUALITY ASSURANCE

MOTOR

TESTS/CHECKS / TEMS/COMPONENTS	Visual	Dimensional	Make/Type/Rating /General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment	Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	Routine & Acceptance tests as per IS-4722 /IS- 9283/IS 2148/IEC60034\IEC 60079-I/ IS-12615	Vibration	Over speed	Tan delta, shaft voltage & polarization index test	Paint shade, thickness & adhesion
Plates for stator frame, end shield, spider etc.	Y	Y	Y	Y	Y				Y										
Shaft	Y	Y	Y	Y	Y	Y			Y										
Magnetic Material	Y	Y	Y	Y			Y			Y		Y							
Rotor Copper/Aluminium	Y	Y	Y	Y			Y		Y										
Stator copper	Y	Y	Y	Y			Y		Y			Y							
SC Ring	Y	Y	Y	Y	Y		Y	Y	Y										
Insulating Material	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											
Castings, stator frame, terminal box and bearing housing etc.	Y	Y	Y	Y	Y			Y											
Fabrication & machining of stator, rotor, terminal box	Y	Y			Y			Y	Y										
Wound stator	Y	Y					Y	Y											
Wound Exciter	Y	Y					Y	Y											
Rotor complete	Y	Y					Y						Y	Y					
Exciter, Stator, Rotor, Terminal Box assembly	Y	Y					Y												
Accessories, RTD, BTD, CT, Space heater, antifriction bearing, gaskets etc.	Y	Y	Y																

CLAUSE NO.	QUALITY ASSURANCE	

Complete Motor	Y	Y	Y												Y	Y	Y	Y1	Y

Note:

1. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, following methodology to be followed for Inspection Categorization:

Note for LT Motor:

i) Motor rating up to 50 KW: Inspection CAT- III : Acceptance of Motor up to 50 KW is based on COC of the Manufacturer and Main Contractor confirming as follows:

"It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage frequency variation, hot starts, pull out torque, starting KVA/KW, temperature rise, distance between center of stud gland plate and tested in accordance with approved drawing /data sheets."

ii) Motor rating above 50 KW & less than 75 KW: Inspection CAT- II as per NTPC approved MQP: Acceptance of Motor rating above 50 KW & less than 75 KW is based on NTPC review of Routine Test inspection report as per IS:12615 - 2018 (including latest revision) duly witnessed by main contractor along with COC of the Manufacturer and Main Contractor confirming as follows:

"It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage frequency variation, hot starts, pull out torque, starting KVA/KW, temperature rise, distance between center of stud gland plate, space heater and tested in accordance with approved drawing /data sheets."

iii) Motor rating 75 KW & above: Inspection CAT-I: As per NTPC approved MQP.

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.
5. For LT Motors, stator core stack length & grade, no load loss and winding resistance w.r.t. type tested motor for IE2/IE3 shall be checked/verified in addition to

Compliance of relevant standard IS:12615/IEC requirement. In case actual results are not within the tolerance limit as declared by manufacturer during QP submission,

the motor shall be subjected to efficiency test.

SECTION III

DOCUMENTS TO BE SUBMITTED BY BIDDER

SECTION IIIA

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

	SCHEDULE OF PERFORMANCE GUARANTEES	SPECN. NO.:	PE-TS-497-100-W001, Rev-0		
		VOLUME:	--	SECTION:	IIIA Sheet 1 of 2
	2x660 MW Talcher TPP	REV. NO.	00	DATE:	6/9/2023

Following parameters are guaranteed for following pumps

SI. No.	Pump Description	Guaranteed Capacity	Guaranteed TDH	Guaranteed Pump Eff.	Guaranteed Motor Eff.	Guaranteed Power consumption at inlet to motor terminals	Motor Rating	Pump GD^2 Value for HT motor only	Pump RPM	T/S Curve attached for HT motor
		(M3/Hr)	(MWC)	%	%	(KW)	(KW)			
	Vertical pumps									
1	# Raw Water (PT) Pumps	2133	21							NA
2	# Raw Water (Ash) Pumps	1165	35							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	SPECN. NO.:	PE-TS-497-100-W001, Rev-0		
		VOLUME:	--	SECTION:	IIIA Sheet 2 of 2
	2x660 MW Talcher TPP	REV. NO.	00	DATE:	6/9/2023

Following parameters are guaranteed for following pumps

SI. No.	Pump Description	Guaranteed Capacity	Guaranteed TDH	Guaranteed Pump Eff.	Guaranteed Motor Eff.	Guaranteed Power consumption at inlet to motor terminals	Motor Rating	Pump GD^2 Value for HT motor only	Pump RPM	T/S Curve attached for HT motor
		(M3/Hr)	(MWC)	%	%	(KW)	(KW)			
	Horizontal pumps									
1	# DMCW-TG Pumps	1000	35.5							NA
2	# DMCW-SG Pumps	1130	41							
3	# ACW Pumps	2041	15.5							NA
4	# DM make-up Pumps	100	70							NA
5	Boiler Fill Pumps	200	145							NA
6	Condensate Transfer Pumps	250	65							NA
7	# CW Make-up Pumps	1430	10							NA
8	# Service Water Pumps	220	55							NA
9	# HVAC Make-up Pumps	100	75							NA
10	APH Wash Pump Pumps	760	85							
11	# Gypsum Wash Pumps	45	22							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

SECTION IIIB

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

	TECHNICAL SPECIFICATIONS	SPECN. NO.:	PE-TS-497-100-W001, Rev.0		
	MISCELLANEOUS PUMPS	VOLUME:	--	SECTION:	IIIB
	COMPLIANCE CERTIFICATE	REV. NO.	0	DATE:	5/9/2023

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

a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions/ deviations with regard to same.

b) QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein.

QP will be subject to BHEL/ CONSULTANT/ CUSTOMER approval in the event of order & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc.

c) All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/ CONSULTANT/ CUSTOMER approval.

d) There are no other deviation with respect to specification other than those furnished in the 'Schedule of Deviations'.

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

Any mandatory spares stated as not applicable, shall have to be supplied without any cost implication to BHEL in the event they are found to be applicable during detail engineering stage.

f) The offered materials should be either equivalent or superior to those specified. Also for components where material is not specified it shall be suitable for intended duty. All materials shall be subject to approval in the event of order.

g) Prices for recommended spares (if any) for 3 years operation shall be furnished separately & not included in the base price.

h) The commissioning spares (if any) are supplied on 'As Required Basis' & prices for same included in the base price (If bidders reply to this is "No commissioning spares are required" and if some spares are actually required during commissioning same shall be supplied by bidder without any cost to BHEL).

i) All sub vendors shall be as per BHEL/CONSULTANT/CUSTOMER approved list.

j) Tests for noise, vibration, parallel running etc. for pumps shall be conducted at site by Pump Vendor/BHEL as per cl. no. 3.04.00 of Section-IIA and if the site performance is found not meeting the requirements in any respect as specified, than the equipment shall be rectified or replaced by the vendor, at his own cost.

k) Any special tools & tackles, if required, shall be in bidder's scope.

l) All models offered have been supplied by bidder in the past and are meeting the experience qualifying criteria of BHEL/CONSULTANT/CUSTOMER (viz. offered model is successfully operating in two separate stations for at least one year or as specified in technical PQR). Any deviation to this criteria shall be suitably highlighted in deviation schedule.

m) All selected motor ratings have minimum margins as per Datasheet A, Section ID.

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

PARTICULARS OF BIDDER/ AUTHORISED REPRESENTATIVE

NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL

SECTION IIIC

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

SECTION IIID

DATA SHEET – B FOR PUMPS

MOTOR DATASHEET-C (AS PER SECTION-1B)

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

1676260/2023/20230823

	PROJECT: MISCELLANEOUS PUMPS DATASHEET - B		VENDOR DOC. NO.		REV NO.	
			BHEL DOC. NO.		REV NO.	

SL.	DESCRIPTION	UOM	PUMP DATA	PUMP DATA	PUMP DATA
1.0	**GENERAL**				
1.1	Desgination 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				

1676260/2023/20230823

	PROJECT: MISCELLANEOUS PUMPS DATASHEET - B	VENDOR DOC. NO.		REV NO.	
		BHEL DOC. NO.		REV NO.	

SL.	DESCRIPTION	UOM	PUMP DATA	PUMP DATA	PUMP DATA
3.8	Specific speed N = RPM x (Flow in USGPM)$^{1/2}$ (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	**MATERTIAL 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^{o}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			

	PROJECT: MISCELLANEOUS PUMPS DATASHEET - B	VENDOR DOC. NO.		REV NO.	
		BHEL DOC. NO.		REV NO.	

SL.	DESCRIPTION	UOM	PUMP DATA	PUMP DATA	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			

CHECKLIST FOR INSTALLATION CHECK OF THE HORIZONTAL PUMP AT SITE			
Note: • To be filled in by BHEL Site Engineer and Pump Vendor Service Engineer • Strike off which is not applicable			
Project Name / PO No.:		**Date of Check:**	
Pump Name:		**Pump Serial No:**	
S. No.	**ACTIVITY DESCRIPTION**	**OBSERVATION**	**REMARKS (IF ANY)**
1.	Relevant Engineering data like General Arrangement Drawing & Cross Sectional Drawing is available with site engineer for reference	Yes/No	
2.	All components are available as per packing list or Approved Documents	Yes/No	
3.	Condition of Pump components	OK/Not OK	
4.	Pump foundation dimensions as per GA drawing (List out deviations if any)	OK/Not OK	
5.	Suction & discharge piping as per GA drawing and pump is free from piping strains.	Yes/No	
6.	Leveling & Center line matching of base plate	OK/Not OK	
7.	Grouting of base plate- Tightness of foundation bolts to be checked	OK/Not OK	
8.	Is there any need of inserting shims under motor, if yes then total thickness of shims provided	Yes/No mm	
9.	Is the pump shaft free to rotate	Yes/No	
10.	Bearings are properly Lubricated (Re-greasing of Bearings to be checked)	Yes/No	
11.	Cooling/Flushing Connections provided for Packing Box/Mech. Seal Assembly	Yes/No	
12.	Radial run out between pump & motor shafts at coupling	mm	
13.	Tightness of bolts between pump-base plate and motor-base plate	OK/Not OK	
14.	No load test of motor performed (As per Pump/Motor Manufacturer Recommendation) If yes then Vibration levels at Drive end of Motor	Yes/No A- V- H-	
15.	Fitment of coupling halves on pump & motor shafts with respective hardwares & key	Ok/Not OK	
16.	Key Slot / Notch for VMS available as per GA Drawing	Yes/No	

17.	Any abnormal observation at this stage. If yes, then specify, trace out the cause & correct it.	Yes/No	
18.	Any abnormal observation during initial trial run of the pumping set, If yes, then specify, trace out the cause & correct it	Yes/No	
19.	Vibration level at **Drive end** of pump	A- V- H-	
20.	Vibration Level at **Non Drive End** of pump	A- V- H-	
21.	Temperature of bearings after initial trial run of one hour (a). At drive end (b). At Non drive end	°C °C	
22.	Max Stabilized temperature of bearings (a). At drive end (b). At non drive end ©. Ambient temp	°C °C °C	
23.	Observed Noise Level at 1meter distance from the Pump	dbA	
24.	Amount of leakage through Gland packing	Permissible/Not Permissible	
25.	Mechanical Seal available at Site (for applicable Pumps only)	Yes/No	

ADDITIONAL REMARKS/OBSERVATION (IF ANY)

1.

2.

3.

Pump Vendor Service Engineer Name Designation Sign & Date	BHEL Site Engineer Name Designation Sign & Date	End Customer (If Required) Name Designation Sign & Date

CHECKLIST FOR INSTALLATION CHECK OF THE VERTICAL PUMP AT SITE			
Note: • To be filled in by BHEL Site Engineer and Pump Vendor Service Engineer • Strike off which is not applicable			
Project Name / PO No.:		**Date of Check:**	
Pump Name:		**Pump Serial No:**	
S. No.	**ACTIVITY DESCRIPTION**	**OBSERVATION**	**REMARKS (IF ANY)**
1.	Relevant Engineering data like General Arrangement Drawing & Cross Sectional Drawing is available with site engineer for reference	Yes/No	
2.	All components are available as per packing list or Approved Documents	Yes/No	
3.	Condition of Pump components	OK/Not OK	
4.	Pump foundation dimensions as per GA drawing (List out deviations if any)	OK/Not OK	
5.	Discharge piping as per GA drawing and pump is free from piping strains.	Yes/No	
6.	Suction Sump Dimensions as per drawing and is free from any debris.	Yes/No	
7.	Check Sole Plate leveling with spirit level	OK/Not OK	
8.	Grouting of sole plate- Tightness of hardware to be checked	OK/Not OK	
9.	Blue matching between sole plate & surface discharge head/ Motor Stand.	Ok/not ok %	
10.	All hardwares are tight	Yes/No	
11.	Is the pump shaft of bowl assembly free to rotate	Yes/No	
12.	Axial play of pump shaft as per design (mm)	OK/Not OK	
13.	Radial run out of line shafts (to be checked on rollers with the help of a dial gauge)As per IS:1710	OK/Not OK	
14.	Check fitment of (a) Line shaft & Line shaft coupling (b) Key in respective Keyway (c) Packing box (d) Free movement of ratchet pin in its pocket	 OK/Not OK OK/Not OK OK/Not OK OK/Not OK	
15.	Tightness of bolts at each joint assembled during erection	OK/Not OK	
16.	Oil level in Thrust stand assembly	Ok/Not OK	
17.	Cooling/ Flushing connections provided for (a) Motor Bearings (b) Pump Thrust Bearing Assembly (c) Packing Box/ Mech. Seal Assembly	 Yes/No/NA Yes/No/NA Yes/No/NA	

1676260/2023/20230823

18.	No load test of motor performed If yes then Vibration levels at Drive end of Motor (Record Vibrations in mm/sec for the driver speed above 600 rpm and also in microns for operating speeds up to and less than 600 rpm)	Yes/No A- V- H-	
19.	Key Slot / Notch for VMS available as per GA Drawing	Yes/No	
20.	Any abnormal observation before pump running. If yes, then specify, trace out the cause & correct it.	Yes/No	
21.	Any abnormal observation during initial trial run of the pumping set, If yes, then specify, trace out the cause & correct it	Yes/No	
.22.	Vibration levels at motor mounting flange (Record Vibrations in mm/sec for the driver speed above 600 rpm and also in microns for operating speeds up to and less than 600 rpm)	A- V- H-	
23.	Temperature of Pump thrust bearing housing (a) After trial run of one hour (b) Maximum Stabilized temperature at pump thrust bearing housing (c) Ambient Temperature	°C °C °C	
24.	Observed Noise Level at 1meter distance from the Pump	dbA	
25.	Amount of leakage through Gland packing/Mechanical Seal	OK/ Not OK	

ADDITIONAL REMARKS/OBSERVATION (IF ANY)

1.

2.

3.

Pump Vendor Service Engineer Name Designation Sign & Date	BHEL Site Engineer Name Designation Sign & Date	End Customer (If Required) Name Designation Sign & Date

1676272/2023/20230823

FORM NO. PEM 6100-0

	PRE - QUALIFYING REQUIREMENTS (TECHNICAL)	TECHNICAL SPECIFICATION NO- PE-TS-497-100-W001, Rev-00 TECHNICAL PQR NO. PE-PQ-497-100-W111 REV NO.: 00 DATED- 06-09-2023
		STANDARD PQR NO: PE-PQ-STD-100-N111 REVISION NO: 04 DATE: 07.02.2020
		SHEET: 1 of 2

ENQUIRY NO:

PROJECT: 2X2660 MW TALCHER TPP

PACKAGE: MISC. PUMPS (HORIZONTAL)

1. The bidder should have designed, manufactured, tested, inspected & supplied the Horizontal Centrifugal pumps for water application with minimum rated flow of 1800 m3/hr , which have been successfully in use for at least 1 year in two different thermal power plants or similar industry/ application and bidder is in business of Horizontal centrifugal pumps for water application on continuous basis.

2. The Bidders shall furnish following support documents for assessment of Bidder w.r.t. PQR as indicated at Sl. No. 1 above:

   A. Bidder's Experience list of Horizontal centrifugal pumps for water application for last 5 years (as on the Enquiry/NIT date) for assessment of bidder for supplying the Horizontal centrifugal pumps for water application on regular basis for establishing business continuity in the enclosed format- Annexure-1.

      Bidder shall furnish the PO copy of at least two (2) executed Contracts as indicated in the experience list.

   B. Bidder shall furnish any one from below in support of successful performance of Horizontal centrifugal pumps for water application for one year:

      i. Satisfactory Performance feedback certificates from End Customer (Owner) (in English) for at least Two successfully executed contracts (from different End customers (Owners) which have been in use for atleast one year indicating salient features like year of commissioning of Horizontal centrifugal pumps for water application, rating of project, flow of Horizontal centrifugal pumps for water application, project name etc., date of issue of certificate and name/ designation of the certificate issuer for power plant/similar application industry. The time duration of Satisfactory performance completion should be before the date of subject Enquiry/NIT.

      OR

      ii. The bidder has been awarded two repeat contracts for Horizontal centrifugal pumps for water application from two different End Customer (Owner) / Purchaser for power plant/similar application industry. Repeat contract shall be considered when the second contract is given by the same purchaser/ owner after lapse of minimum 1 year from execution (viz. supply) of first contract. Supporting documents for execution of the first contract like dispatch [N2] details or commissioning report or PG test report along with the PO Copy to be furnished, if bidder intends to submit the documents for Repeat Contracts. The date of repeat contract order should not be later than the date of subject Enquiry/NIT.

PREPARED BY:	REVIEWED BY:	APPROVED BY:
NAME: DESIGNATION / DEPT.:	NAME: DESIGNATION / DEPT.:	NAME: DESIGNATION / DEPT.:

	PRE - QUALIFYING REQUIREMENTS (TECHNICAL)	TECHNICAL SPECIFICATION NO- PE-TS-497-100-W001 TECHNICAL PQR NO. PE-PQ-497-100-W111 REV NO.: 00 DATED- 06-09-2023
		STANDARD PQR NO: PE-PQ-STD-100-N111 REVISION NO: 04 DATE: 07.02.2020
		SHEET: 2 of 2

OR

iii. Satisfactory Performance feedback certificates from End Customer (Owner) (in English) for one successfully executed contract which have been successfully in use for atleast one year indicating salient features like year of commissioning of Horizontal centrifugal pumps for water application, rating of project, flow of Horizontal centrifugal pumps for water application, project name etc., date of issue of certificate and name/ designation of the certificate issuer for power plant/similar application industry. The time duration of Satisfactory performance completion should be before the date of subject Enquiry/NIT.

AND

The bidder has been awarded repeat contracts for Horizontal centrifugal pumps for water application from minimum one End customer (owner)/Purchaser (other than the one for which the bidder has furnished the performance feedback above) for power plant/similar application industry. Repeat contract shall be considered when the second contract is given by the same purchaser/ owner after lapse of minimum 1 year from execution of first contract (viz. supply). Supporting documents for execution of the first contract like dispatch [N2] details or commissioning report or PG test report along with the PO Copy to be furnished, if bidder intends to submit the documents for Repeat Contracts. The date of repeat contract order should not be later than the date of subject Enquiry/NIT.

Notes:-

N1 -Purchase order copy, Supporting drawings/technical data sheets etc. are to be submitted along with the bid for which the bidder intends to furnish the performance feedbacks / repeat contracts for reference purpose only.

N2 - Dispatch details shall include any one of the following documents:

a.Tax Invoice.

b.Site receipt/Receipted LR.

c.Customer's material dispatch clearance certificate.

Any additional document required in support of above documents to establish the correlation between the above documents and the supplied item shall be provided by the bidder.

N3. Purchase order for spare items shall not be considered as repeat order qualifying criteria.

N4. Bidder to submit all supporting documents in English. If documents submitted by bidder are in language other than English, a self-attested English translated document should also be submitted.

N5. Notwithstanding anything stated above, BHEL reserves the right to assess the capabilities and capacity of the bidder/collaborators to perform the contract, should the circumstances warrant such assessment in the overall interest of BHEL.

N6. After satisfactory fulfilment of all the above criteria/ requirement, offer shall be considered for further evaluation as per NIT and all the other terms of the tender.

EXPERIENCE LIST

PROJECT NAME	CUSTOMER	PUMP PARAMETERS		PUMP MODEL	NO. OF PUMPS	TYPE OF FLUID	YEAR OF CONTRACT EXECUTION/ SUPPLY	TYPE OF PUMP	PERFORMANE FEEDBACK CERTIFICATE ENCLOSED (Y/N)
		FLOW (Cu M/Hr.)	TDH (MWC)						

1675812/2023/20230823

FORM NO. PEM 6100-0

BHEL	PRE - QUALIFYING REQUIREMENTS (TECHNICAL)	TECHNICAL SPECIFICATION NO- PE-TS-497-100-W001 TECHNICAL PQR NO. PE-PQ-497-100-W114 REV NO.-00 DATED: 06.09.2023
		STANDARD PQR NO: PE-PQ-STD-100-N113 REVISION NO: 04 DATE: 07.02.2020
		SHEET: 1 of 2

ENQUIRY NO:

PROJECT: 2X660 MW TALCHER TPP

PACKAGE: MISC. PUMPS (VERTICAL)

1. The bidder should have designed, manufactured, tested, inspected & supplied the Vertical Centrifugal pumps for water application with minimum rated flow of 1900 m3/hr, which have been successfully in use for at least 1 year in two different thermal power plants or similar industry/ application and bidder is in business of Vertical centrifugal pumps for water application on continuous basis.

2. The Bidders shall furnish following support documents for assessment of Bidder w.r.t. PQR as indicated at Sl. No. 1 above:

   A. Bidder's Experience list of Vertical centrifugal pumps for water application for last 5 years (as on the Enquiry/NIT date) for assessment of bidder for supplying the Vertical centrifugal pumps for water application on regular basis for establishing business continuity in the enclosed format- Annexure-1.

      Bidder shall furnish the PO copy of at least two (2) executed Contracts as indicated in the experience list.

   B. Bidder shall furnish any one from below in support of successful performance of Vertical centrifugal pumps for water application for one year:

      i. Satisfactory Performance feedback certificates from End Customer (Owner) (in English) for at least Two successfully executed contracts (from different End customers (Owners) which have been in use for atleast one year indicating salient features like year of commissioning of Vertical centrifugal pumps for water application, rating of project, flow of Vertical centrifugal pumps for water application, project name etc., date of issue of certificate and name/ designation of the certificate issuer for power plant/similar application industry. The time duration of Satisfactory performance completion should be before the date of subject Enquiry/NIT.

      OR

      ii. The bidder has been awarded two repeat contracts for Vertical centrifugal pumps for water application from two different End Customer (Owner) / Purchaser for power plant/similar application industry. Repeat contract shall be considered when the second contract is given by the same purchaser/ owner after lapse of minimum 1 year from execution (viz. supply) of first contract. Supporting documents for execution of the first contract like dispatch [N2] details or commissioning report or PG test report along with the PO Copy to be furnished, if bidder intends to submit the documents for Repeat Contracts. The date of repeat contract order should not be later than the date of subject Enquiry/NIT.

PREPARED BY:	REVIEWED BY:	APPROVED BY:
NAME: DESIGNATION / DEPT.:	NAME: DESIGNATION / DEPT.:	NAME: DESIGNATION / DEPT.:

	PRE - QUALIFYING REQUIREMENTS (TECHNICAL)	TECHNICAL SPECIFICATION NO- TECHNICAL PQR NO. REV NO. DATED STANDARD PQR NO: PE-PQ-STD-100-N113 REVISION NO: 04 DATE: 07.02.2020 SHEET: 2 of 2

OR

iii. Satisfactory Performance feedback certificates from End Customer (Owner) (in English) for one successfully executed contract which have been successfully in use for atleast one year indicating salient features like year of commissioning of Vertical centrifugal pumps for water application, rating of project, flow of Vertical centrifugal pumps for water application, project name etc., date of issue of certificate and name/ designation of the certificate issuer for power plant/similar application industry. The time duration of Satisfactory performance completion should be before the date of subject Enquiry/NIT.

AND

The bidder has been awarded repeat contracts for Vertical centrifugal pumps for water application from minimum one End customer (owner)/Purchaser (other than the one for which the bidder has furnished the performance feedback above) for power plant/similar application industry. Repeat contract shall be considered when the second contract is given by the same purchaser/ owner after lapse of minimum 1 year from execution of first contract (viz. supply).Supporting documents for execution of the first contract like dispatch [N2] details or commissioning report or PG test report along with the PO Copy to be furnished, if bidder intends to submit the documents for Repeat Contracts. The date of repeat contract order should not be later than the date of subject Enquiry/NIT.

Notes:-

N1 -Purchase order copy, Supporting drawings/technical data sheets etc. are to be submitted along with the bid for which the bidder intends to furnish the performance feedbacks / repeat contracts for reference purpose only.

N2 - Dispatch details shall include any one of the following documents:

a.Tax Invoice.

b.Site receipt/Receipted LR.

c.Customer’s material dispatch clearance certificate.

Any additional document required in support of above documents to establish the correlation between the above documents and the supplied item shall be provided by the bidder.

N3. Purchase order for spare items shall not be considered as repeat order qualifying criteria

N4. Bidder to submit all supporting documents in English. If documents submitted by bidder are in language other than English, a self-attested English translated document should also be submitted.

N5. Notwithstanding anything stated above, BHEL reserves the right to assess the capabilities and capacity of the bidder/collaborators to perform the contract, should the circumstances warrant such assessment in the overall interest of BHEL.

N6. After satisfactory fulfilment of all the above criteria/ requirement, offer shall be considered for further evaluation as per NIT and all the other terms of the tender.

EXPERIENCE LIST

PROJECT NAME	CUSTOMER	PUMP PARAMETERS		PUMP MODEL	NO. OF PUMPS	TYPE OF FLUID	YEAR OF CONTRACT EXECUTION/ SUPPLY	TYPE OF PUMP	PERFORMANE FEEDBACK CERTIFICATE ENCLOSED (Y/N)
		FLOW (Cu M/Hr.)	TDH (MWC)						