

2X660 MW MAITREE BANGLADESH (BIFPCL)

**TECHNICAL SPECIFICATION
FOR
MISCELLANEOUS PUMPS**

Specification No. : PE-TS-421-100-N001 (REV. 01)



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



TITLE:
**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPEC. NO.: **PE-TS-421-100-N001** (R01)

SECTION:

SUB-SECTION:

REV. NO. **0** DATE 05/03/19

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

INDEX

THIS TECHNICAL SPECIFICATION CONSISTS OF FOLLOWING SECTIONS:

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IIIB	Compliance Certificate (To be submitted along with the Bid by all Bidders)
IIIC	Deviation schedule (To be submitted along with the Bid by all Bidders)
IIID	Data Sheet – B and Other documents (To be submitted by successful Bidder after award of Contract)

Notes:

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

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



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SECTION - I

SPECIFIC TECHNICAL REQUIREMENTS

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

SUB-SECTION IB - ~~Specific Technical Requirements (Electrical)~~

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

SUB-SECTION ID – Datasheet-A



TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-421-100-N001** (R01)

SECTION: **I**

SUB-SECTION: **IA**

REV. NO. **0** DATE 05/03/19

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SUB-SECTION – IA

SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)

	TECHNICAL SPECIFICATIONS		Specification No. : PE-TS-421-100-N001, Rev.01		
	MISCELLANEOUS PUMPS		SECTION:		IA
	SPECIFIC TECHNICAL REQUIREMENTS		REV. NO.	00	DATE: 05-03-2019

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

2X660 MW MAITREE BANGLADESH (BIFPCL)

1.2

The miscellaneous pumps covered under this specification shall be grouped under various types as under:

A. Vertical

i. Vertical Pumps

NOTE:-

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

2. Bidder shall include complete scope for supplies and services in his scope. Part scope offered shall disqualify the bidder's offer.

1.3

The miscellaneous pumps and drives covered under this specification for various projects are as per Annexure-1 of this section. HT drives, wherever applicable and irrespective of motor ratings, shall be issued free of cost by BHEL. The details of pumps with HT drives shall be as per Annexure-2 of this section.

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

1.4

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

1.5

BLANK

1.6

DELIVERY:

Delivery of miscellaneous pumps shall be as per NIT requirement.

1.7

(1) For design & standards of Misc. pumps (Materials specification, pumps, piping, flanges, valves, testing procedures etc) please refer clause no B.0.6.2 of Appendix-III.

(2) Indian Standards and Chinese Standards are NOT acceptable. Wherever international standards have been mentioned same shall not include Indian and Chinese standards.

(3) wherever 'IS' code is indicated in this specification, equivalent international code is to be used as per clause 1.7(1) above.

1.8

Flexible & Elastic coupling to be provided for all pumps.

1.9

No external water shall be provided for any lubrication/cooling. Any such requirement of pump shall be taken care by self water by pump supplier.

1.10

Maximum size impeller for pump casing shall not be quoted. On replacing new impellar, minimum 5% head increase shall be possible for all pumps. Pump head with new impeller shall also be indicated in guarantee schedule (refer section-III) and selection of motor rating shall be based upon this higher head. This higher head is not to be considered for guaranteed auxiliary power calculation.

1.11

PG Test shall be applicable for all pumps as per Clause 3.04.04 of Sub-Section IIA.

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1.12 Rated capacity of coupling must be at least 120% of the maximum power required to be transmitted.

1.13 Additional requirements of end customer are attached as Appendix-I, Appendix-II & Appendix-III.

Note: The required margin on pump flow (10%) as per Appendix-I has been considered while indicating pump rated flow in Datasheet-A at Section -ID

2.0 For all HT Motor driven pumps (Vertical), following instruments/accessories to be provided:

2.1 Reverse rotation Measurement System/Switch Indicator to be provided with all the HT Motor Driven Pumps by bidder. The Technical Specification for Reverse Rotation Monitoring System is attached in Section IC.

2.2 For HT motor driven pumps, temperature measurement including Temperature Transmitter for continuous monitoring shall be provided. Technical specification for same is attached in Section-IC

3.0 Available Pump Drive HT motors:

3.1 HT motors indicated in annexure-2 of this section, have been manufactured considering the corresponding pump requirements and same can not be altered now. Further the GA & T-S curve for HT motors are attached as annexure-A in this section. Bidder to select offered pumps so that these HT motors are compatible to offered pumps.

4.0 Vertical Pumps (Raw water Pumps) :

4.1 Hydraulic Sump Model Study/ test to be conducted for Pump House housing Raw Water pumps by the Bidder. Dimensions of pump chamber/ sump in the Pump house shall be fixed up initially by BHEL based on Hydraulic Institute Standard (Preliminary Layout is attached as Annexure-3). The dimensions shall be confirmed by Pump Vendor by conducting a Hydraulic Model Study at a recognised Institute/ hydraulic research laboratory(subject to BHEL/End Customer Acceptance of Sump Model Study/Testing Agency). Scale of the model shall be 1:10. The hydraulic model study shall be conducted to study water level in the pump sump, flow conditions in the pump sump for different discharges & different depths of water, different combinations of pump operations to study velocity distribution in pump bays, etc. for screening & pump station.

The model shall be based on Froude’s law of similitude and shall also be tested for following two more flow conditions, viz.

a. At twice the prototype maximum Froude number, i.e., the Froude number of the model is two times that of the prototype.

b. At equal velocity criterion, i.e., the velocity is same both in the model and prototype.

The final recommendation shall be based on 2F condition. Based on recommendations of the hydraulic model study, necessary modifications shall be made in the pump sump, forebay & channel, additional structural features required such as flow straighteners, baffle walls, mesh screens, grid walls, guide vanes, floor splitters, anti - swirl cone etc. for elimination of non - uniform velocity distribution, swirls and vortices in the model etc.

Pump Vendor shall furnish procedure for Sump Model Study within One (1) month from LOI. BHEL and/or End Customer shall review/approve the Procedure for Sump Model Study and physical test conductance shall be intimated by the Pump vendor in advance for witness of Sump Model Study by BHEL/End Customer as per Approved Procedure.

4.2 Tubular casing & pull out design to be provided.

4.3 Self lubrication system (if required or envisaged by bidder) shall be provided by bidder taking water for this purpose from pump discharge, no external water shall be made available for this purpose.

4.4 Non-Reverse Ratchet Mechanism to be provided for all vertical pumps.

4.5 Reverse rotation lock to be provided for all vertical pumps

4.6 Mechanical seal to be provided for all vertical pumps.

4.7 Vertical type pumps to be provided with foundation frame.

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4.8 Anti Vortex Devices (e.g. inlet splitter, if required by sump model tests as per clause no. 4.1 above) to be installed on pump inlet suction bell is to be provided for vertical pumps 5.0 Additional Dispatch Requirements: 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 item 5.4 Sea worthy packing shall be applicable for all supplies. 6.0 <u>Drawing/Document Submission Schedule:</u>																																										
<table><tr><th>PACKAGE</th><th>BHEL DRG NO</th><th>DRG TITLE</th><th>Drg Sch for Vendors</th><th>Remarks</th></tr><tr><td rowspan="8">MISC.PUMPS (VERTICAL)</td><td colspan="5">Primary Documents</td></tr><tr><td>Maitree-00-PCC-MDA-116201-PEM</td><td>TDS AND PERFORMACE CURVES-MISC. PUMPS</td><td rowspan="3">R-0 within 14 days from LOI/PO & subsequent revisions within 7 days of comments received from BHEL.</td><td rowspan="3"></td></tr><tr><td>Maitree-00-PCC-MLU-116202-PEM</td><td>GENERAL ARRANGEMENT AND CROSS SECTIONAL-PUMPS</td></tr><tr><td>Maitree-00-PCC-MQA-116204-PEM</td><td>QP-MISC PUMPS</td></tr><tr><td colspan="5">Secondary Documents</td></tr><tr><td>Maitree-00-PCC-MFE-116207</td><td>O& M MANUAL -VERT. PUMPS</td><td>Preliminary with standard O & M document within 7 days from LOI/PO and final including approved documents and test certificates within 30 days from MDCC</td><td></td></tr><tr><td>Maitree-00-PCC-MFE-116208</td><td>PG TEST PROCEDURE -VERT. PUMPS</td><td>R-0 within 14 days of Cat-I(or)II approval on pump document.</td><td></td></tr><tr><td>Maitree-00-PCC-MFE-116209</td><td>PROCEDURE FOR SUMP MODEL STUDY</td><td>Within One (1) month from LOI</td><td></td></tr></table>							PACKAGE	BHEL DRG NO	DRG TITLE	Drg Sch for Vendors	Remarks	MISC.PUMPS (VERTICAL)	Primary Documents					Maitree-00-PCC-MDA-116201-PEM	TDS AND PERFORMACE CURVES-MISC. PUMPS	R-0 within 14 days from LOI/PO & subsequent revisions within 7 days of comments received from BHEL.		Maitree-00-PCC-MLU-116202-PEM	GENERAL ARRANGEMENT AND CROSS SECTIONAL-PUMPS	Maitree-00-PCC-MQA-116204-PEM	QP-MISC PUMPS	Secondary Documents					Maitree-00-PCC-MFE-116207	O& M MANUAL -VERT. PUMPS	Preliminary with standard O & M document within 7 days from LOI/PO and final including approved documents and test certificates within 30 days from MDCC		Maitree-00-PCC-MFE-116208	PG TEST PROCEDURE -VERT. PUMPS	R-0 within 14 days of Cat-I(or)II approval on pump document.		Maitree-00-PCC-MFE-116209	PROCEDURE FOR SUMP MODEL STUDY	Within One (1) month from LOI	
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7.0 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. In case of any contradiction in different clauses/parts of Section-I, the most stringent requirement shall prevail. 8.0 For final documentation refer clause no B.0.3.9.4 of Appendix-III.																																										



TECHNICAL SPECIFICATIONS
MISCELLANEOUS PUMPS
SPECIFIC TECHNICAL REQUIREMENTS

Specification No. : PE-TS-421-100-N001, Rev.01

SECTION:

IA

REV. NO.

00

DATE:

05-03-2019

Annexure-1

List of Miscellaneous Pumps and drives for :

A. 2X660 MW MAITREE BANGLADESH (BIFPCL)

Sl. No.	Pump Description	Total Qty.	Type of Pumps
	Vertical Pumps		
1	RAW WATER PUMPS	5 nos.	Vertical

	TECHNICAL SPECIFICATIONS		Specification No. : PE-TS-421-100-N001, Rev.01		
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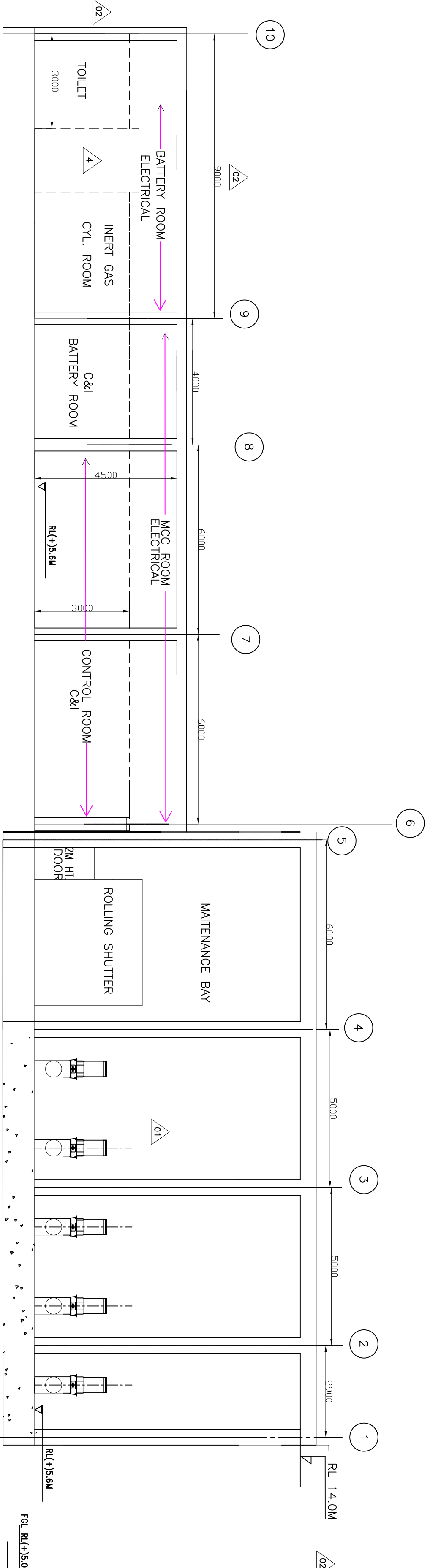
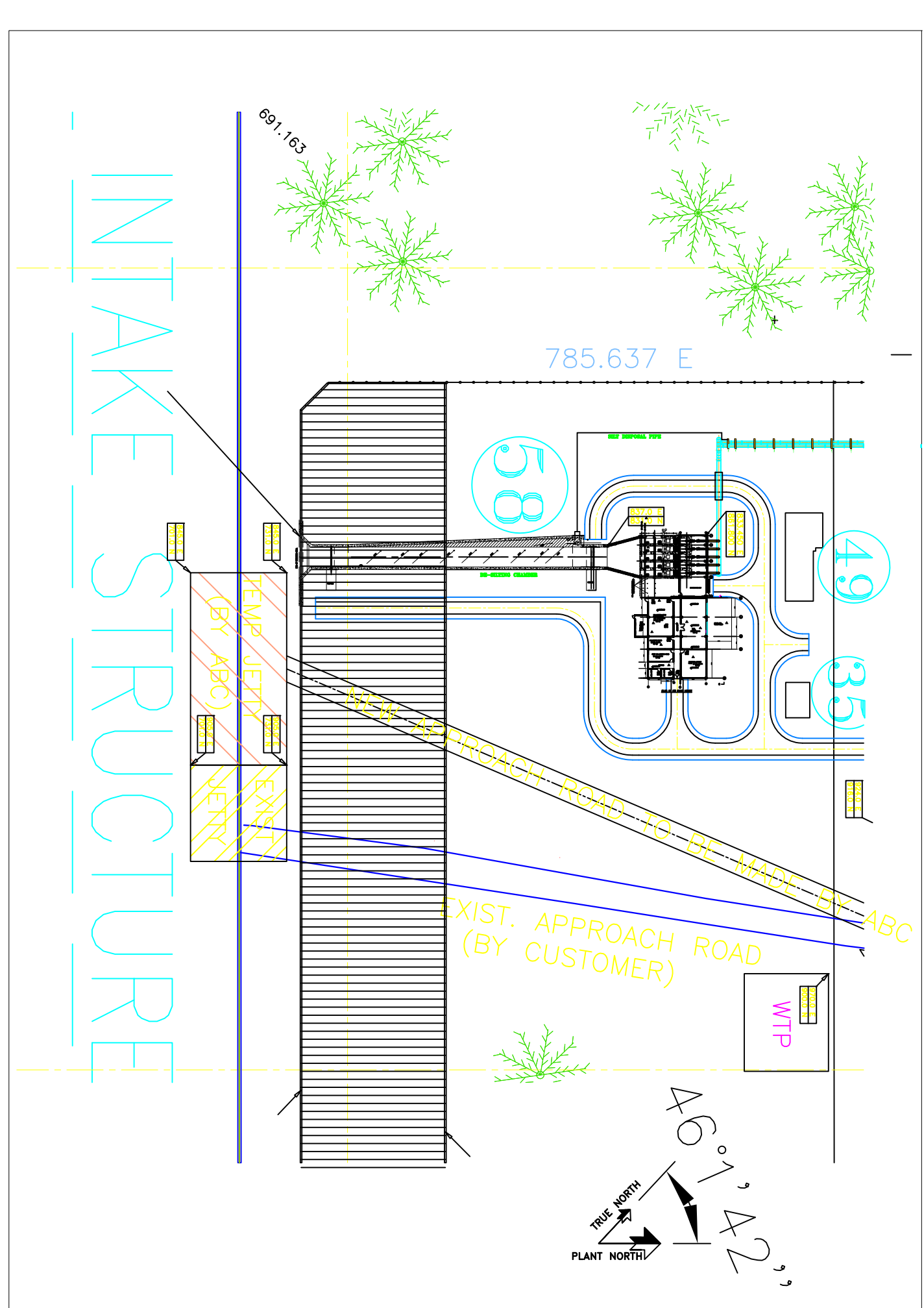
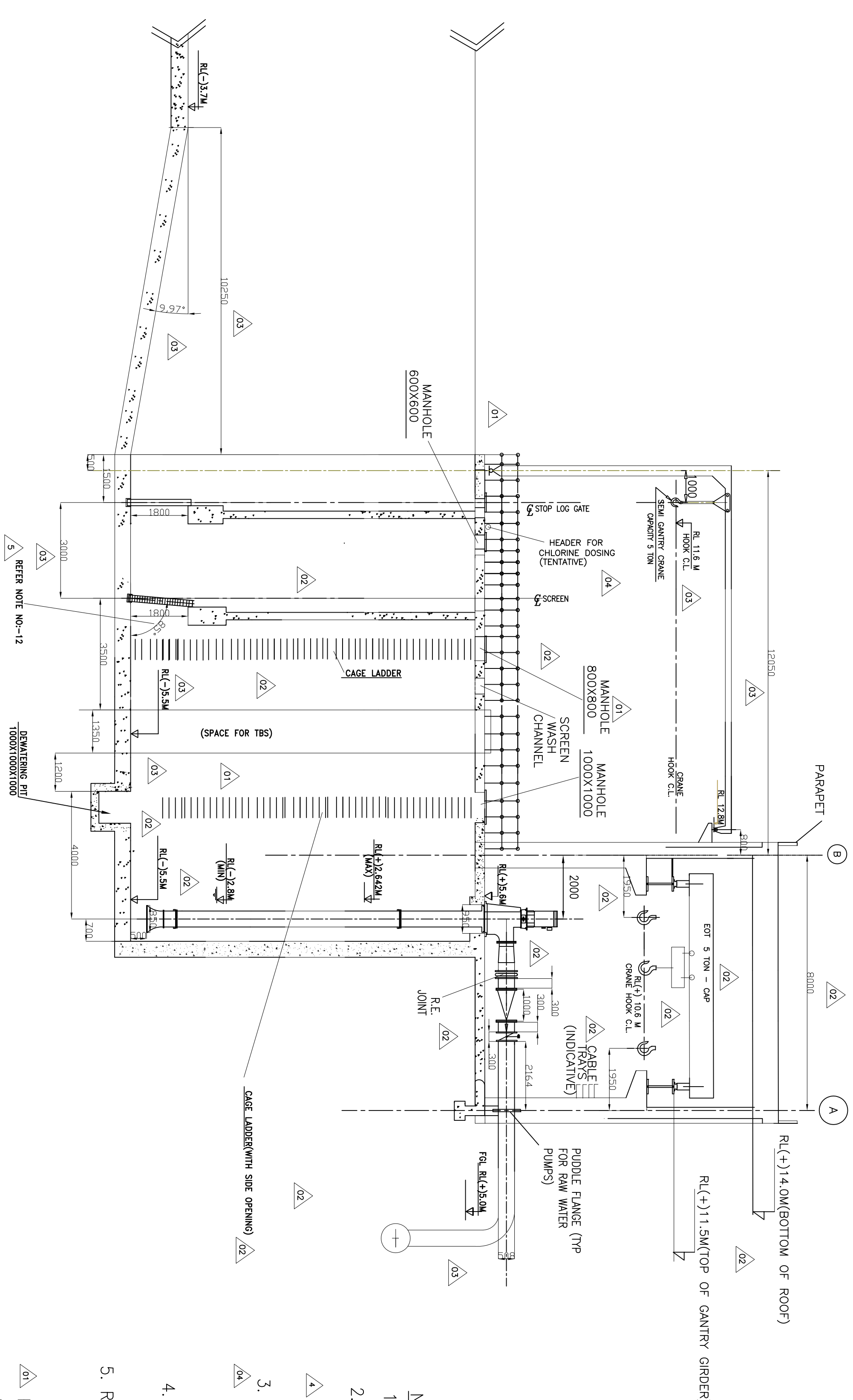
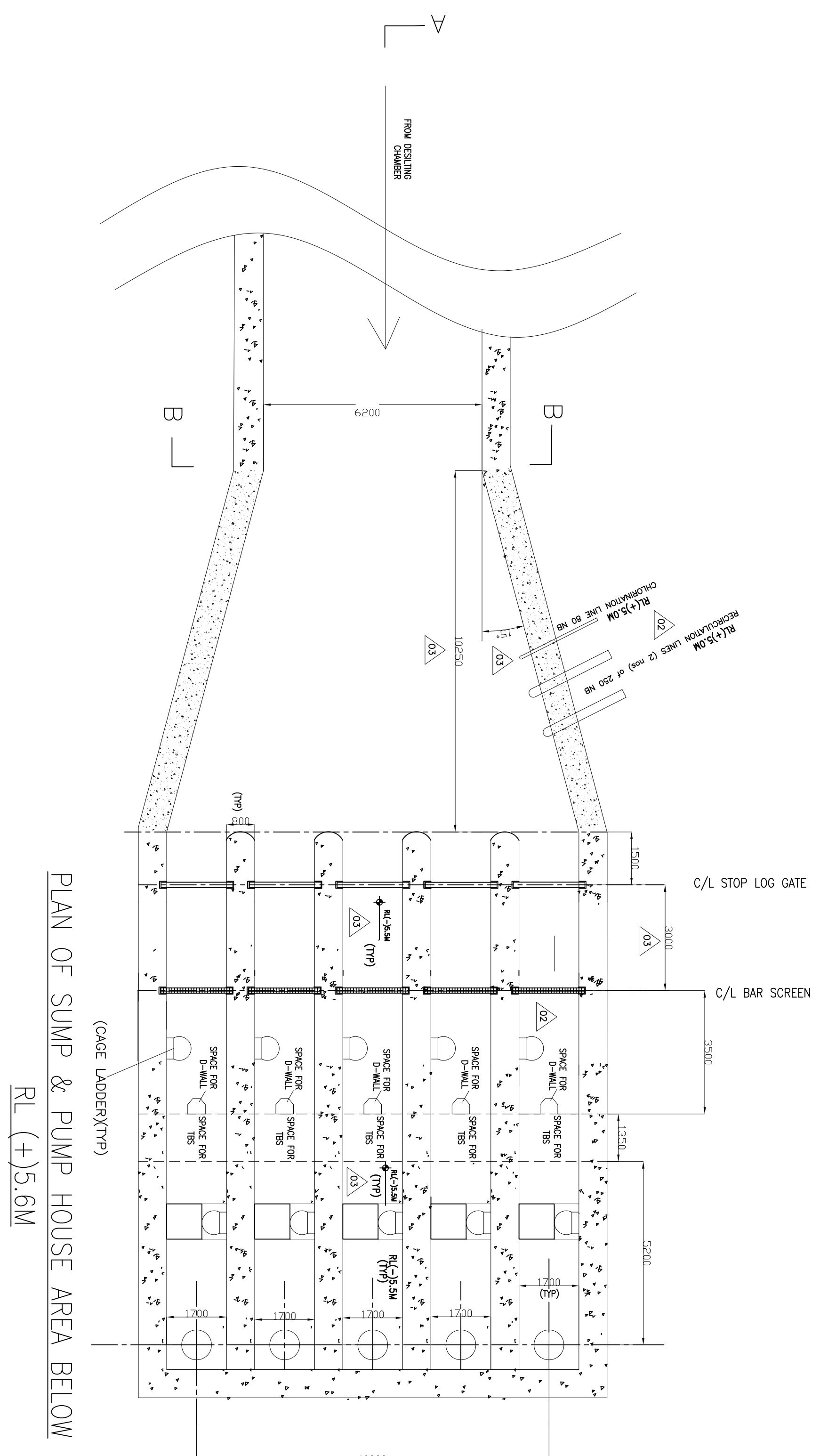
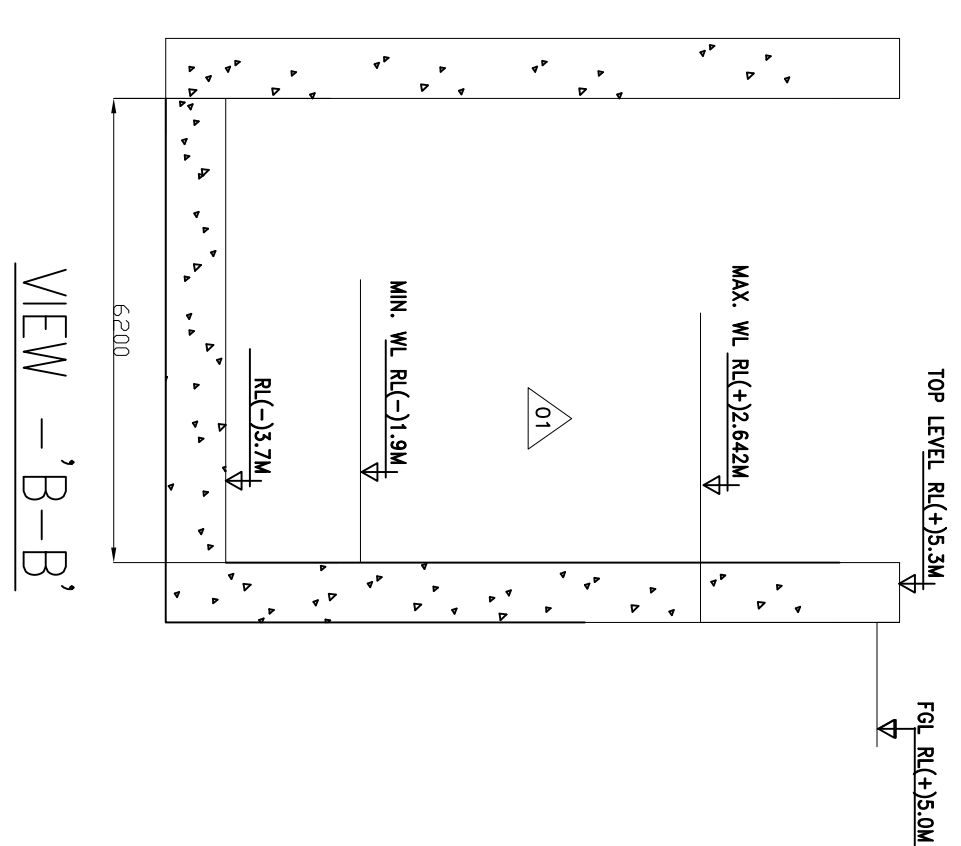
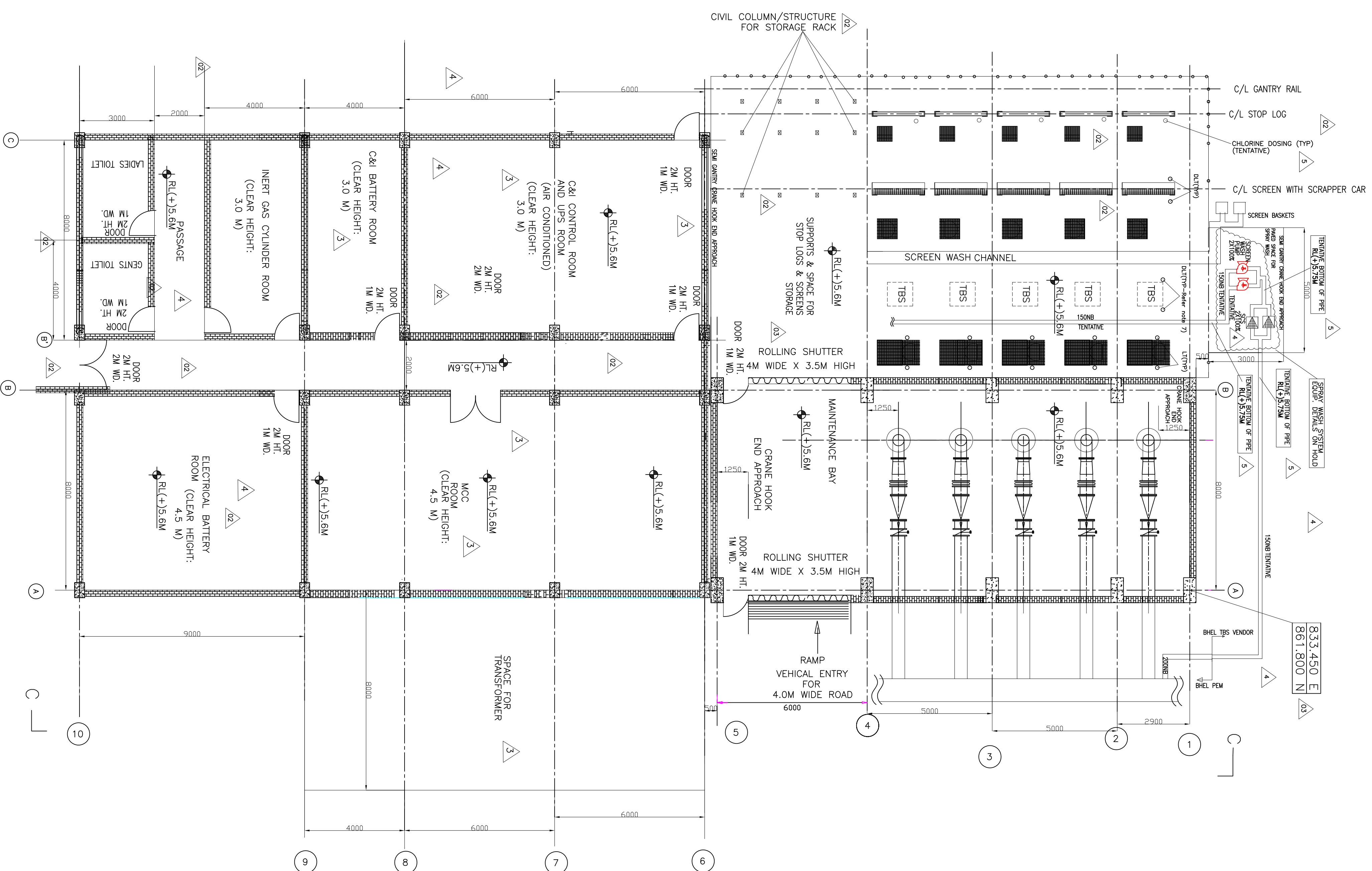
Annexure-2

Following HT drives for 2X660 MW MAITREE BANGLADESH (BIFPCL), irrespective of Motor ratings shall be issue free, by BHEL:

Vertical Pumps :

1 RAW WATER PUMPS

	TECHNICAL SPECIFICATIONS	SPECIFICATION NO.:	Specification No. : PE-TS-421-100-N001, Rev.01		
	MISCELLANEOUS PUMPS	VOLUME:	IIB	SECTION:	D1
		REV. NO.	0	DATE:	05-03-2019
A. SEA WATER ANALYSIS ATTACHED AFTER DATASHEET A OF SECTION ID.					



1. ALL DIMENSIONS ARE IN MM AND ALL ELEVATIONS ARE IN METRES UNLESS OTHERWISE STATED. 2. STOP LOG GATE (TOTAL 3 NO. COMMON FOR RAW WATER SUMP) OF HOT DIP GALVANISED STEEL SHALL BE PROVIDED TO ENSURE ITS ANTI-CORROSION AND SUITABLE PAINTING (EPOXY BASED) TO BE DONE AS PER TABLE A.7 OF DIN EN ISO 12944-5:2008 & COARSE BAR SCREENS OF SS 316 Ti OR APPROVED EQUIVALENT & OF 50MM SPACING BETWEEN BARS (05 NOS. VZ 1 NOS. FOR EACH SUMP) SHALL BE PROVIDED BY BHEL CIVIL CONTRACTOR. 3. 1 NO. OVERHEAD EOT. CRANE OF 5 TON CAP., 16.5 M LIFT, 8.0 M SPAN & 19 M TRAVEL SHALL BE PROVIDED BY BHEL PEM MAX. TRAVEL 22.9 M FOR HANDLING OF SCREENS, GATE & TRS SHALL BE PROVIDED BY BHEL PEM MAX. 4. ALL ELEVATIONS ARE REFERRED TO THE LOCAL FOL OF RAW WATER PUMP HOUSE WHICH CORRESPONDS TO RL(+5.0 M, (RL(+ 5.0M=MSL(+5.0M). 5. REFERENCE DOCUMENTS: PLOT PLAN :MATTREE-0-MB-UD-421100M001PEM PLANT WATER SYSTEM P&ID :MATTREE-00-P-MFB-116001-PEM PLANT WATER SYSTEM DESIGN PHILOSOPHY & SYSTEM WRITE – UP :Maitree-00-P-MFE-116002-PEM MECHANICAL GA OF DESIGN CHAMBER: Maitree-00-P-MLH-116009-PEM WATER BALANCE DIAGRAM :MATTREE-00-P-MFB-116010-PEM ELECTRICAL EQUIPMENT & CABLING LAYOUT: MATTREE-00-BTW-EDB-421100ED01-PEM LAYOUT OF INTAKE WATER PIPING- MATTREE-00-CAC-MB-120016-PEM 6. PLATFORM FOR PUMP MOTOR SHALL BE PROVIDED BY BHEL-CIVIL CONTRACTOR. 7. ACTUAL LOCATION OF DLT SHALL BE BASED UPON GA DRAINING OF TSS PACKAGE. SAME TO BE USED FOR CIVIL DRG PURPOSE. 8. ACCESS ROAD FOR PAVED AREA FOR GATE & SCREENS & SCREENING BASKETS ARE PROVIDED. KEY PLAN MAY BE REFERRED. 9. SUMP MODEL STUDY SHALL BE CARRIED OUT BY APPROVED INDEPENDENT AGENCY FOR RW SUMP & FOREBAY , AND REQUISITE HYDRAULIC ELEMENTS SHALL BE INCORPORATED IN CIVIL WORKS, IF REQUIRED, AS PER STUDIES 10. ROUTING OF CABLES AT PUMP FLOOR(RL+5.6M) FROM COLUMN/ROW-A TO PUMP MOTOR WILL BE BY CONDUITS FULLY EMBEDDED IN THE FLOOR. FOR DETAILS PLEASE REFER ELECTRICAL EQUIPMENT & CABLING LAYOUT: MATTREE-00-BTW-EDB-421100ED01-PEM 11. SCRAPPER CAR ARRANGEMENT EQUIPMENT DETAILS SHALL BE FURNISHED LATER AS IT IS A BOUGHT OUT ITEM. 12. DLT ANGLE OF BAR SCREEN CAN BE 85 DEG. OR 90 DEG. BASED UPON RECOMMENDATION OF SCRAPPER CAR ARRANGEMENT SUPPLIER.		PROJECT : 25600MW MATTREE SUPER THERMAL POWER PROJECT, RAJAL, BANGLADESH (BPC MAIN PLANT PACKAGES) OWNER : CONQUEST POWER DESIGNED BY : PROJECTER GROUP & Co Kt. DRAWN BY : STUART CERBANY CHECKED BY : STUART CERBANY APPROVED BY : STUART CERBANY SUPERSEDES BY : STUART CERBANY STATION : STATION		TITLE : MECHANICAL GA OF RAW WATER PUMP HOUSE SCALE : 1:100 SHEET : 1 of 1	
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NO	DATE	USER	DESCRIPTION
04	18/7/19	NK	NR/AL
05	18/7/19	NK	NR/AL
03	07/07/19	NK	NR/AL
02	07/06/18	NK	NR/AL
01	02/04/18	NK	NR/AL
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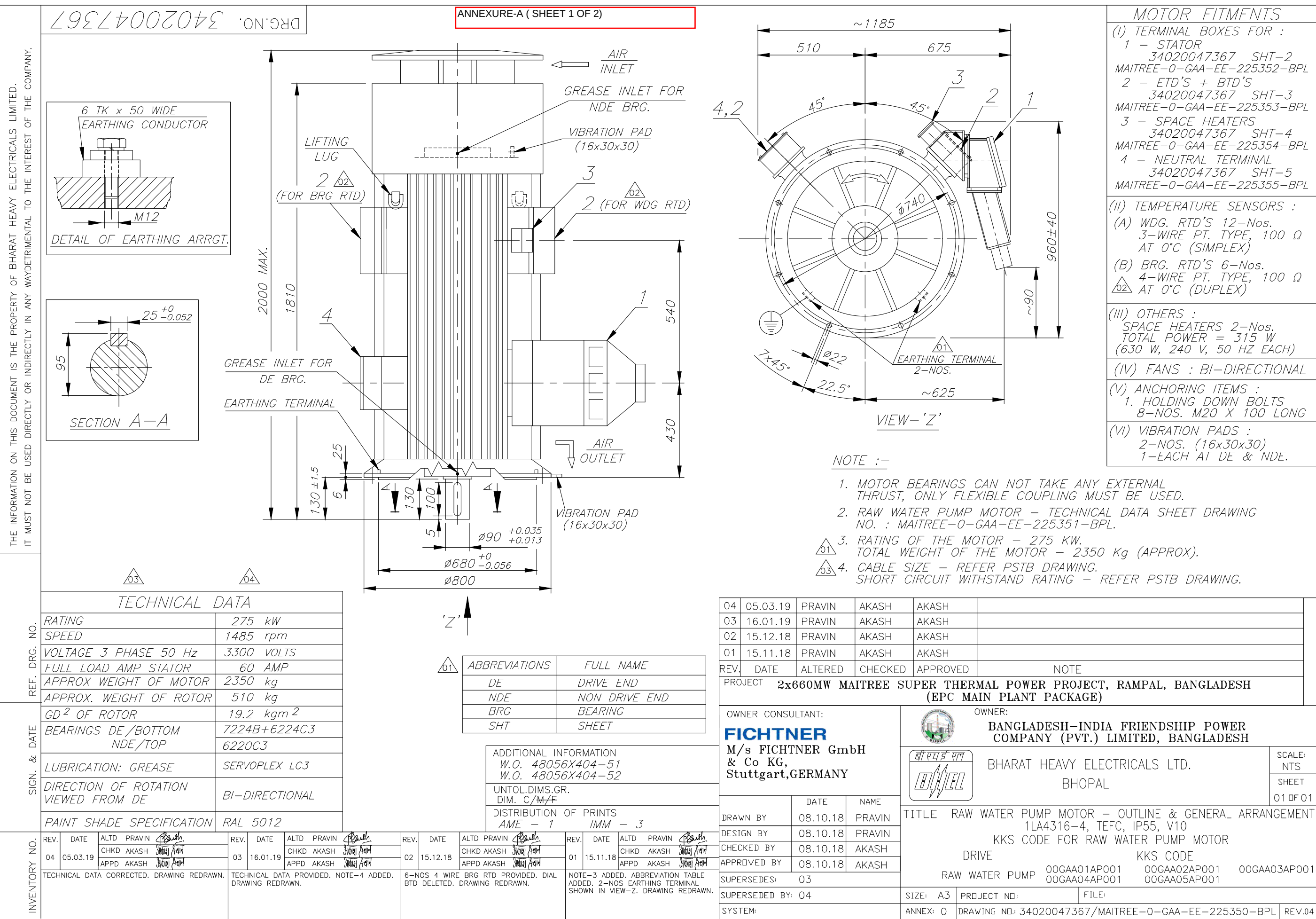
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			NOTE

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01	02/04/18	NK	NR/AL
DATE	ALTERED	CHECKED	APPROVED
			NOTE

NO	DATE	USER	DESCRIPTION
04	18/7/19	NK	NR/AL

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)





BHARAT HEAVY ELECTRICALS LIMITED, BHOPAL

A.C. MACHINES ENGINEERING DIVISION

MOTOR TECHNICAL DATA (Rev 01)

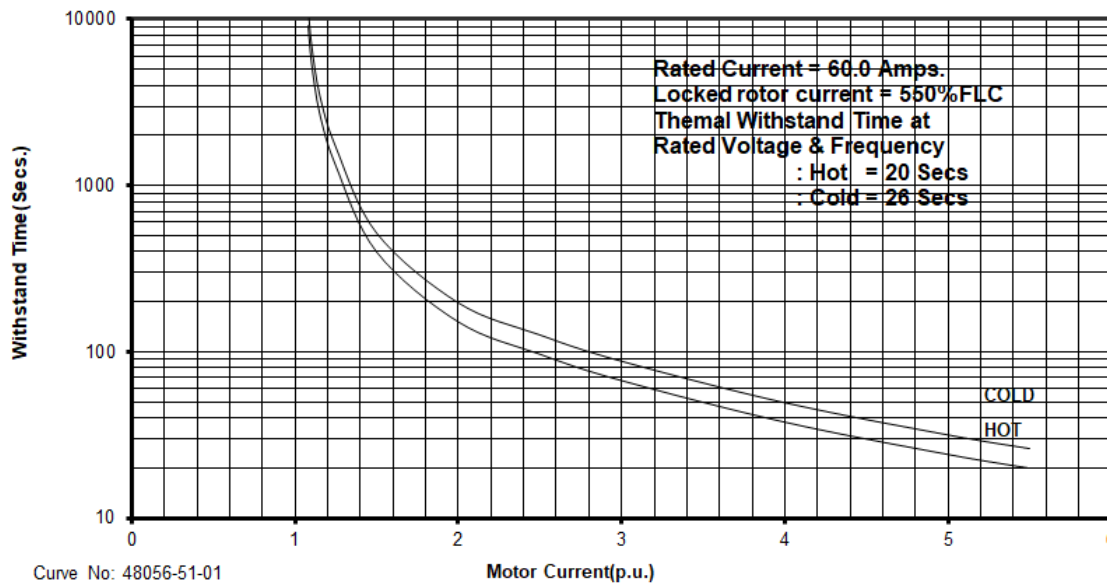
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Sheet 6 of 8



Thermal Withstand Curves

Rating : 275 KW, 3.3 kV, 4 P, TEFC, SQ.Cage Induction Motor.
Frame : 1LA4316-4
W.O.No. : 48056X401-51/52
Customer : M/S BANGLADESH INDIA FRIENDSHIP POWER CO LTD .
Project : MAITREE 2X660 MW STPP BANGLADESH

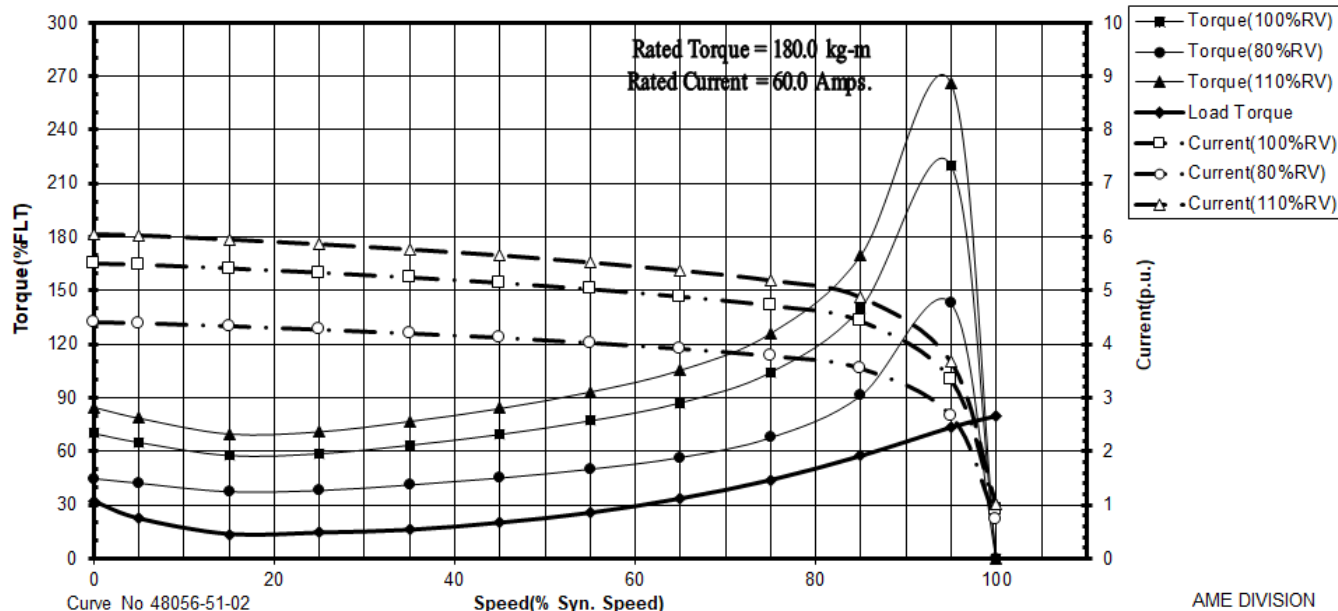


AME DIVISION



Torque & Current Vs Speed Curves

Rating : 275 KW, 3.3 kV, 4 P, TEFC, SQ.Cage Induction Motor.
Frame : 1LA4316-4
W.O.No. : 48056X401-51/52
Customer : M/S BANGLADESH INDIA FRIENDSHIP POWER CO LTD .
Project : MAITREE 2X660 MW STPP BANGLADESH



AME DIVISION

APPENDIX-I



B0.6.17 Mechanical equipment

B0.6.17.1 Pumps

General

All pumps shall be designed for continuous operation unless otherwise specified.



Pumps shall be installed in positions convenient for operation and servicing. Where multiple pump installations are required, each pump and its associated equipment shall be arranged in such a manner as to permit easy access for operation, maintenance and pump removal without interrupting plant operation.

Pumps installed for parallel operation or as stand-by sets are to be of identical design, i.e. interchangeable.

Lifting lugs and eyes and other special tackle shall be provided as necessary to permit easy handling of the pump and its components.



General design and construction

All pumps shall be designed to withstand a test pressure of 1.5 times the maximum possible pump shutoff pressure under maximum suction pressure conditions. If a pump can operate at sub-atmospheric suction conditions, the entire pump shall be designed for full vacuum.

All pump shafts shall be of ample size to transmit the maximum possible output from the prime mover. The pump shaft and coupling are to be so dimensioned that the maximum permissible torque of the shaft is higher than the maximum transmissible torque of the coupling. Directly coupled pumps shall be used preferably.

Renewable wear rings shall be provided at points of running clearance and shall be made from appropriate materials.

All pumps and accessories in contact with the pumped fluid shall be constructed of materials specifically designed for the conditions and nature of the pumped fluid, and be resistant to erosion and corrosion.

Product water flushing lines and drains are to be supplied for each pump handling the prevailing river water to avoid corrosion if the pump is out of operation for extended periods.

The pump glands or mechanical seals shall be so arranged that repackaging or fitting of replacement seals can be carried out with the minimum of disruption to plant operation. In case of operating under vacuum conditions liquid sealing is to be provided.

The pump casing shall preferably be split for ease of maintenance and be designed such that the impeller and shaft are capable of being withdrawn from the casing without disturbing any of the main pipework and valves carrying the pumped fluid. In general, all horizontal pumps with draw-out-rotors are to be fitted with a coupling to facilitate disassembly without removing the motor. Pull-out design of the shaft shall be applied to vertical wet pit and dry pit pumps as well.

Each horizontal pump shall be mounted with its drive on a common base plate of rigid construction. Vertical pumps are to be provided with foundation frames. In case of submersible pumps suitable frames shall be provided in the pump sump. It shall however be possible to remove these pumps without entering the sump.

Pumps must be carefully set to ensure that the net positive suction head available under all operating conditions will be adequate for the type of pump employed. The NPSH values are to be referred to the least favourable operating conditions - lowest atmospheric pressure, lowest level of water on the suction side of the pump, and highest temperature of the pumped fluid. An adequate safety margin of normally greater than 1 m to the max NPSH required shall be provided.

Pumps shall operate smoothly throughout the speed range up to their operating speeds. The first coupled critical speed must be at least 20% higher than the maximum operating speed. The determination of the shaft diameter and the distance between two consecutive bearings must include a sufficiently large safety margin to satisfy this condition.

Where necessary, the pumps are to be fitted with devices to ensure a minimum throughput.

Bearings

For large pumps the bearings shall be of automatic oil lubricated sleeve type, unless otherwise specified. Bearings on vertical shaft pumps shall be so spaced to prevent shaft whipping or vibration under any mode of operation. Vibration sensors and temperature measurements incl. temperature transmitters for continuous monitoring shall be provided for large pumps.

Bearings housings on horizontal shaft pumps shall be designed to enable the bearings to be replaced without removing the pump or motor from its mounting. Bearing housings on horizontal shaft pumps shall be effectively protected against the ingress of water, pumped fluid and dust by suitable nonferrous deflectors.

All bearing oil wells shall be fitted with visual oil level indicators. Non-pressure-oil lubricated bearings shall be equipped with constant level oilers.

Pumps characteristics

When several pumps are installed for the same service, they shall be suitable for unrestricted parallel operation.

The pump flow/head characteristics shall be such that within the operation range the head will continuously increase with decreasing flow, maximum head (shut off head) being at least 10% higher than the duty point head.

Unless otherwise specified all pumps shall be capable of operating at 110% of the rated capacity at the rated delivery head. Maximum size impellers for the pump body in question shall not be quoted for. By installation of a new impeller a head increase of 5% minimum shall be possible. The performance of the drive motor is to be determined according to the above mentioned technical requirements and to the requirements as specified in the electrical part.

Fittings

All pumps shall be installed with isolating valves, a non-return valve and suction and discharge pressure gauges unless otherwise stated. Accessible couplings shall be supplied with removable type guards.

Coupling halves shall be machine matched to ensure accurate alignment. Couplings as well as gears must have a rated capacity of at least 120% of the maximum potential power transmission requirement.

All pumps other than submersible pumps shall have temporary strainers fitted in the suction pipework during all initial running and commissioning phases. Permanent strainers shall be provided where specified.

Venting valves shall be fitted to all pumps at suitable points on the pump casing unless the pump is self-venting, due to the arrangement of the suction and discharge nozzles. Drainage facilities shall be provided on the pump casing or adjacent pipework to facilitate the dismantling of pumps.

All positive displacement pumps shall be fitted with a discharge relief valve capable of passing the maximum pump delivery flow.



APPENDIX-II



B5.3.4 Pumps

B5.3.4.1 RAW WATER PUMPS



Casing

The pumps shall have tubular casings.

In order to maintain the blade clearances, interchangeable wearing rings made of stainless steel are to be used. The clearances must be adjustable later on without difficulty. The plant water supply pumps should be fitted with bell-mouth intakes. If necessary these should also be provided with

anti-vortex devices and other guide arrangements. Welded bell-mouths (segmented) are not acceptable.

The pumps shall be supported on slabs which withstand vibrations at various frequencies. Therefore, it is essential that the natural vibration frequency of supporting system should differ from the vibration frequency of the moving equipment by a sufficient margin to avoid resonance that could cause excessive vibration, noise and subsequent damage to the whole system (foundation and equipment).

Rotor components

The impeller and the impeller wearing rings shall be made of Super Duplex stainless steel with effective corrosion and erosion resisting properties.

The shaft shall be of Super Duplex and shall have protecting sleeves in the place of sleeve type guide bearings.

Lubricating liquid (filtered river water, if references are available, else service water) shall be provided for the guide bearings.

It is necessary for the shaft guidance to be subcritical, with a wide safety margin between the rotational speed and the first critical speed.

All components shall be fully machined. Rotating parts shall be statically and dynamically balanced, separately and together.

For the couplings high-grade makes shall be used. The rated capacity must be at least 110% of the maximum power required to be transmitted.

Screw type connections along the shaft of the pump will not be accepted.

The pumps shall be preferably designed so that it is possible to withdraw the rotor without dismantling the pump casing from the foundation frame or surrounding piping (pull-out design).

Glands

Plant water supply pump glands shall be provided with mechanical seals of approved design. These shall be of a type which will allow replacement of the sealing faces to be carried out without major dismantling of any part of the unit. If necessary it shall be provided with a system which will supply the glands with flushing water (filtered river water or service water) both prior to starting the pump and also while the pump is running.

Bearings

The various pump bearings shall be designed as plain bearings. To avoid excessive vibration an adequate number of intermediate guide bearings shall be provided for the shaft.

The thrust bearing must be capable of safely absorbing all static, dynamic and maximum possible hydraulic forces.

Water lubricated closed shaft pumps, with cutless rubber-lined guide bearings, shall be provided.

Separate thrust bearings in the pumps and in the motors with elastic coupling between them shall be provided for all pumps.

The thrust bearing metal shall have emergency running properties.

Back stop

The pump sets shall be fitted with reverse rotation locks or shall be so designed that they are capable of reverse rotation. The basis to be taken is the case of full delivery pressure with fully open combined shut-off non-return valve.

Lubrication and cooling

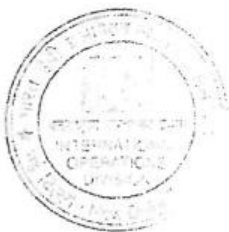
Water lubrication shall be provided for the journal bearings and oil lubrication shall be provided for the thrust bearings. To cool the lubricating oil and to lubricate the shaft bearings the pumped fluid shall be used.

The lubricating oil system shall be of external pressuring type equipped with separate oil coolers. An oil bath type lubricating system with cooling coils can be offered as an alternative.

Forced oil lubrication shall be provided by a shaft-driven, self-priming oil pump having a capacity adequate for the combined requirements of the pump and motor bearings.

In addition, a motor driven emergency oil pump of similar capacity to the main oil pump shall be provided, arranged to start automatically in the event of the failure or loss of pressure of the main oil supply.

To protect the cooling water consumers of the pump set against sand particles or similar contaminating matter, the lubricating and cooling water shall be passed through an amply sized double-mesh changeover filter, and if necessary, a booster pump shall be installed. If cooling coils are used for



8



cooling the lubricating oil in the sump, then these shall be constructed in one piece, i.e. with no brazed joints.

The water lubricated guide bearings have to be lubricated during start-up. If this is not assured by submergence at minimum water level, auxiliary lubricating water connections from an outside source (other operating pumps or from the system filling pumps) shall be provided. On the auxiliary water connections solenoid valves shall be fitted.

The necessary cooling water through flow shall be adjustable on each pump by means of a throttle device. For components in contact with seawater, sea water resistant material as duplex or similar is to be selected.

APPENDIX-III

B0.3.9.4 Requirements for documentation

Unless agreed otherwise, five (5) hard copies and three (3) sets of electronic copies of all documents are to be submitted in the English language. In addition, operation and maintenance manuals shall be translated into Bangla and provided as paper copies and in electronic format. Electronic Copies shall be submitted in primary original data format (e.g. DOC, XLS, DWG) as well as in a printable non-proprietary document format (e.g. PDF). Especially P&IDs shall be submitted as DWG files and PDF files.

The Contractor shall provide, install, operate and maintain a web based electronic data room / data server. The format and filing system shall be mutually agreed between Employer and Contractor.

All documentation shall comply with uniform documentation instructions according to Employer's requirements. Detailed requirements for documentation will be determined during contract execution by the Employer.

Contractor shall comply with Employer's directive concerning documentation requirements for implementation in an automated plant operation system.

The final documentation including but not limited to operating manuals, maintenance and service manuals, component documentation, assembly documentation, drawings and listing, etc. shall be submitted in the English

language. In addition, operation and maintenance manuals shall be translated into Bangla and provided as paper copies and in electronic format.

Contractor shall also integrate and submit all the above data for each Unit into the PSS®E load flow raw data file ("raw data") and PSS®E dynamic raw data file ("dyr data") which are ready to be used for studies on operation and planning of the Grid System by PGCB using PSS®E (to be confirm by PGCB/BIFPCL)

Data for each Unit shall also include reactive power capability curve of the Facility, written in the format compatible to PSS®E activity GCAP. For this purpose, at least 10 (ten) pairs of data on the generator reactive power capability curve shall be provided for each Unit.

The final requirements for Transmission lines and Interconnecting Facilities documentation will be subjected to PGCB's approval which will be made known during execution stage.

B0.6.2 Standards and codes

The work must be performed according to the most recent relevant codes, standards, accident prevention regulations and local rules and legal regulations.

All materials and equipment supplied and all work carried out as well as calculation sheets, drawings, quality and class of goods, methods of inspection, specific design features of equipment and parts and acceptances of partial plants shall comply in every respect with the applicable standards, codes and regulations to be chosen from the following:

- American Association of State Highway and Transportation Officials AASHTO

• American Concrete Institute	ACI
• American Gear Manufacturers Association	AGMA
• American Institute of Steel Construction	AISC
• American Iron & Steel Institute	AISI
• American Moving and Conditioning Association	AMCA
• American National Standards Institute	ANSI
• American Petroleum Institute	API
• American Public Health Association	APHA
• American Society for Testing and Materials	ASTM
• American Society of Civil Engineers	ASCE
• American Society of Heating, Refrigeration & Air Conditioning Engineers	ASHRAE
• American Society of Mechanical Engineers	ASME
• American Water Works Association	AWWA
• American Welding Society	AWS
• American Wire Gauge	AWG
• Anti-Friction Bearing Manufactures Association	AFBMA
• Architectural Institute of Japan	AIJ
• Association Francaise de Normalisation	AFNOR
• British Standards Institute	BS
• Chlorine Institute	CI
• Crane Manufacturers Association of America	CMAA
• Deutsches Institut für Normung	DIN
• Diesel Engine Manufacturers Association	DEMA
• European Norm	EN
• Expansion Joint Manufacturer Association	EJMA
• Fédération Européenne de Manutention	FEM
• Heat Exchanger Institute	HEI
• Hydraulic Institute	HI
• Illuminated Engineers Society	IES
• Institute of Electrical and Electronics Engineers	IEEE
• Instrument Society of America	ISA
• Insulated Power Cable Engineers Association	IPCEA
• International Electrotechnical Commission	IEC
• International Standards Organization	ISO
• Japanese Architectural Standard Specification	JASS
• Japanese Electrical Manufacturers Association	JEMA
• Japanese Electrotechnical Institute	JEC
• Japanese Industrial Standards	JIS
• Manufacturers Standardization Society	MSS
• National Association of Corrosion Engineers	NACE
• National Electrical Code (USA)	NEC
• National Electrical Manufacturer's	NEMA

Association (USA)	
• National Electrical Safety Code	NESC
• National Fire Protection Association	NFPA
• National Structural Code for Building	NSCB
• Occupation Safety and Health Administration	OSHA
• Portland Cement Association	PCA
• Properties of Water and Steam	IFC
• Scientific Apparatus Manufacturers Association	SAMA
• Society of Automotive Engineers	ASE
• Standards of Japanese Electrotechnical Committee	JEC
• Steel Structures Painting Council	SSPC
• Technische Vereinigung der Grosskraftwerksbetreiber	VGB
• Tubular Exchanger Manufacturers Association	TEMA
• Underwriters Laboratory	UL
• Uniform Building Code	UBC
• Verband Deutscher Elektrotechniker	VDE
• Verein Deutscher Ingenieure	VDI
• Vereinigung Deutscher Elektrizitätswerke (Association of German Power Plants)	VDEW
• Water Pollution Control Federation	WPCF

Generally, all internationally and nationally recognized standards as above will be applied, except if specific standards called for by:

- a) Occupational Safety Board of Bangladesh
- b) Department of Inspection for Factories and Establishments, Bangladesh
- c) Department of Environment, Bangladesh
- d) Bangladesh Power Development Board
- e) Bangladesh Energy Regulatory Commission
- f) Ministry of Power, Energy and Mineral Resources
- g) Bangladesh Fire Service and Civil Defence Ministry
- h) All relevant Bangladesh National Statutory Regulations
- i) Bangladesh National Building Code
- j) Bangladesh Standards
- k) Local Authorities.

All steam boilers and unfired pressure vessels together with associated pipework and fittings shall comply with the Bangladesh Boiler Act, 1923 with amendments.

All pressure parts shall be designed in accordance with applicable ASME codes.

All services, supplies and works shall comply with the requirements of the relevant laws of Bangladesh and the IFC/World Bank Group Standards and Guidelines in their latest edition, including but not limited to:

- Environmental Conservation Rules
- Bangladesh Energy Regulatory Commission Act;
- BERC Licensing Regulation
- BERC Technical Quality Standards;
- Bangladesh National Building Code;
- other applicable laws in Bangladesh;
- IFC Performance Standards on Environmental and Social Sustainability;
- IFC / World Bank Group Environmental, Health and Safety (EHS) General Guidelines ;
- IFC / World Bank Group EHS Guidelines for Thermal Power Plants;
- IFC / World Bank Group EHS Guidelines for Electric Power Transmission and Distribution.

It is the Contractor's responsibility to provide sufficient evidence that any national or other standard the Contractor proposes (other than those mentioned above) will ensure an equivalent or higher standard.

Immediately after effective date of the Contract the Contractor shall supply an indexed list of all standards, codes and associated standards referred to, to which the work is to be performed. A copy of all applied standards shall be forwarded to the Employer. The Contractor shall supply preferably two (2) searchable softcopies, else two (2) hardcopies each.



TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-421-100-N001**

SECTION: **I**

SUB-SECTION: **ID**

REV. NO. **0** DATE **14/03/18**

SHEET **2** OF **1**

SUB-SECTION – IC

SPECIFIC TECHNICAL REQUIREMENTS (C&I)



Specific Technical Requirement
For
Miscellaneous pump

2X660 MW STPP
MAITREE - BANGALDESH

1. Vibration monitoring system for large pumps is in BHEL scope. However, bidder to provide vibration pad for mounting of sensors and a notch/slot for mounting of key phasor.

2. Bidder to provide temperature measurements as per below specification:

Temperature measurements:

Glass thermometers, bi-metallic and capillary remote thermometers are to be used for local temperature measurement. For both, class 1.0 shall be provided. Glass thermometers are to be inserted into pockets provided for the purpose. The use of mercury is forbidden. Capillary remote thermometers shall be with a case diameter of preferably 160 mm and must be mounted on fixtures or instrument panels in such a way that they are protected from vibration, jarring and sprayed water. The capillary tube must be laid in a protected position. If possible, resistance thermometers (Pt-100) in accordance with IEC 60751 shall be used for remote measurements. All resistance thermometers shall be wired according to the four-conductor principle. Otherwise, thermocouples with appropriate heat resistance in accordance with DIN IEC 60584-1 or equivalent may be used for remote measurements. All thermocouples shall be of the quick response type, ungrounded and preferably of double element type. Thermocouples shall be arranged in such a way that the ambient temperature of the head is lower than 100 °C, and that the measuring inserts can easily be exchanged.

All thermocouples and extension leads shall be terminated with a suitable gland and the conductor to sheath resistance shall be greater than 100 MOhms when tested after termination. Thermometers and thermocouples shall generally be fitted in protective wells. They shall be provided with weatherproof terminal heads and shall be installed so as to totally prevent the ingress of foreign matter. High speed response pockets shall be provided for all applications involving control of critical process temperatures.

Where more than one temperature measurement e.g. for redundant loops, recording, indication, automatic control is to be made at one location, individual protective wells with sensors shall be provided at the common place of measurement. Protective wells for unoccupied test measuring points shall be arranged with the opening inclined downwards wherever possible and shall be provided with a screw-on protection cover.

Insofar as local conditions or extreme temperature do not require otherwise, screw-in immersion wells for exhaust gas and air shall meet the following requirements: nominal length not less than 0.5 m attachment of the well in the wall of the exhaust gas channel or air duct must be gas-proof.

For the measurement of temperature of other media, the following requirements shall be observed: For all pipework a minimum immersion depth of 55 mm in the internal pipeline cross-section and a minimum distance of 15 mm from the opposite pipe wall must be provided. If the diameter of the pipeline does not allow the thermometer to be inserted perpendicular to the pipe axis while still maintaining the above mentioned measurements, another solution must be found in cooperation with the Employer/



Specific Technical Requirement
For
Miscellaneous pump

2X660 MW STPP
MAITREE - BANGALDESH

Engineer. When determining the lengths of the insertion and connecting tubes the insulation thickness is to be taken into consideration. For all remote temperature measurements (i.e. for RTDs and TCs) transmitters shall be installed locally in a transmitter protecting box on a DIN rail. Temperature transmitter for winding and bearing temperature measurements shall be supplied by BHEL.

2.1. TEMPERATURE ELEMENT AND ACCESSORIES:

a. Thermocouple

Sr. No.	Features	Essential/Minimum Requirements
1	Type of Thermocouple.	: 16 AWG wire of Chromel-Alumel (Type K) or 24 AWG wire Pt-Rhodium Pt (Type R) depending on operating temperature Range (ungrounded type).
2	No. of element	: Duplex
3	Housing/Head	: IP-65/Diecast Aluminium. Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter (as applicable). Plug in connectors are to be provided for external signal cable connection.
4	Sheathing of Thermocouple	: Swaged type magnesium oxide insulation.
5	Calibration and accuracy	: As per IEC-751/ANSI-C-96.1(special class) for T/C.
6	Characteristic	: Linear with respect to temp, within $\pm 1/2$ percent of top range value.
7	Accessories	: Thermo well (as specified below) and shall be spring loaded for positive contacts with the well.
8	Standard	: ANSI C 96.1 for Thermocouple and ASME PTC-19.3 for Thermo-well.

b. Thermowell (for all process temp. elements)

Shall be one-piece solid bored type of 316 SS of step-less tapered design. (As per latest ASME PTC 19.3).



Specific Technical Requirement
For
Miscellaneous pump

2X660 MW STPP
MAITREE - BANGALDESH

c. 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.
4	Sheathing of RTD	: Metal sheathed, ceramic packed
5	Calibration and accuracy	: As per DIN-43760 Class-A for RTD
6	Characteristic	: Linear with respect to temp, within $\pm 1/2$ percent of top range value.
7	Accessories	: Thermo well (as specified below) and shall be spring loaded for positive contacts with the well.
8	Standard	: DIN-43760 for RTD and ASME PTC-19.3 for Thermo-well.

NOTES:

- 1) The specifications for RTDs of winding/ bearings of motor/pump, can be as per their manufacturer standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice. However, the type of RTD shall be Pt100.
- 2) The specifications of temp elements for the system / process shall be subject to customer's approval.

3. Bidder to terminate all winding and bearing temperature measurements at Junction box. Junction box is in bidder scope. For Junction box specification is as below:

Junction boxes

In order to simplify local collection of cables and distribution of signals and to centralize connections in the Plant the junction boxes shall be fitted on all the necessary: cable crossover terminal points, electrical actuators, central collecting points for individual analog and binary signals and local transmitters, central distribution points for local signals.

The necessary intermediate terminal boxes must at least have degree of protection IP 55 in accordance with EN 60529 and must be equipped with the necessary terminal strips and attachment components for the connection of the cables. The necessary earthing terminals shall be provided for the earthing of the boxes. In hazardous areas, terminal boxes shall be in accordance with EN 50019 or 50020, depending on zone classification. After commissioning, the junction boxes, marshalling racks, instrument



Specific Technical Requirement
For
Miscellaneous pump

2X660 MW STPP
MAITREE - BANGALDESH

racks, etc. must contain at least 10% of spare space. The Contractor shall furthermore provide at least 10% of fully fitted spare terminal capacity.

FIELD MOUNTED LOCAL JUNCTION BOXES

- | | | |
|-------|------------------------|---|
| (i) | No. of ways | 12/24/36/48/64/72/96/128 with 20% spares terminals. |
| (ii) | Material and Thickness | 4mm thick Fiberglass Reinforced Polyester (FRP). |
| (iii) | Type | Door gasket shall be of synthetic rubber. |
-
- | | | |
|-------|---------------------------------|--|
| iv) | Mounting clamps and accessories | Suitable for mounting on walls, columns, structures etc. The brackets, bolts, nuts, screws, glands and lugs required for erection shall be of brass, included in Bidders scope of supply. Raceways shall be provided inside JB's for proper termination of cables. |
| v) | Type of terminal blocks | Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm ² . A M6 earthing stud shall be provided. |
| vi) | Protection Class | IP: 55 minimum for indoor & IP-65 minimum for outdoor applications. |
| vii) | Grounding | To be provided. |
| viii) | Color | To be decided during detailed engineering & subject to Employer's approval. |



TITLE:
**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-421-100-N001** R01

SECTION: **I**

SUB-SECTION: **ID**

REV. NO. **0** DATE 05/03/19

SHEET **3** OF **1**

SUB-SECTION – ID

DATASHEET-A

	DATA SHEET - A	SPECIFICATION NO.: PE-TS-421-100-N001 (R01)
	MISCELLANEOUS PUMPS (Vertical Pumps)	
	2X660 MW MAITREE BANGLADESH STPP	
Sl. No.	DESCRIPTION	RAW WATER PUMPS
1.0	SERVICE	
1.1	Total no. of pumps for Project	5
1.2	No. of working & standby pumps	(4W+1S) for station
1.3	Liquid Handled (ref. water analysis enclosed herein)	Sea Water
1.4	Location	RAW Water P/H
1.4.1	Indoor / Outdoor	Indoor
1.5	Duty	Continuous
1.6	Specific gravity	1.03
1.7	No. of pumps working in parallel	4
1.8	System design pressure (kg/sqcm), g	7
2.0	DESIGN PARAMETERS	
2.1	Design capacity each, M ³ /hr	1820
2.2	Total dynamic head (MWC) (At Bowl, excluding Pumps Internal frictional losses upto discharge)	37
2.3	• Suction Pressure(MWC)	Atmospheric
	• Floor Level- for Pump Mounting	RL (+) 5.6 M
	• Min. W.L	RL (-) 2.8 M
	• Max. W.L.	RL (+) 2.642 M
	• Sump Invert Level	RL (-) 5.5 M
	• Crane Hook Level	RL (+) 10.6 M
	• Crane Capacity Available	5 Ton
2.4	Design Temperature (°C)	50
2.5	Speed of pump (RPM)	1485
2.6	Max. limit on shut off head Corresponding to pump TDH (MWC) at 51.5 Hz	Not to exceed 63 MWC
2.7	Pump Discharge - above floor / below floor	Above Floor
2.8	Discharge pipe (ODXTHK),(mmxmm)	508 X 9.53
2.9	Operating range	30-130% of design duty point flow
2.10	Motor rating	Drive Motor shall be rated, at an ambient temp. Of 50 Deg C, with a margin of at least 10 % above the maximum load demand of pump considering clause no. 1.10 of Section-IA, in the operating range (including run out condition of pump and shut off condition) whichever is higher including voltage and frequency variation.
2.11	Permissible tolerance in rated capacity & TDH	no negative tolerance
2.12	Permissible tolerance in efficiency at rated capacity(%)	no negative tolerance
2.13	Performance/Design Standard	HIS
3.0	CONSTRUCTION FEATURES	
3.1	Pump type	Vertical Type with Pull out design
3.2	Impeller type	Closed
3.3	Casing type	Vertical Type Tubular casing
3.4	Coupling type	Flexible & Elastic type
3.5	Sealing arrangement	Mechanical Seal
3.6	Type of Lubrication	Self Water
3.7	Pump characteristics	Non Overloading type & stable
3.8	Drain Plugs, vent with valve, lifting lugs, etc.	To be Provided
4.0	MATERIALS OF CONSTRUCTION	
4.1	Casing & Suction Bell	18 % Ni CI D2 TYPE /Duplex SS
4.2	Column Pipe	Duplex SS
4.3	Shaft enclosing tube (if applicable)	Duplex SS

	DATA SHEET - A	SPECIFICATION NO.: PE-TS-421-100-N001 (R01)
	MISCELLANEOUS PUMPS (Vertical Pumps)	
	2X660 MW MAITREE BANGLADESH STPP	
Sl. No.	DESCRIPTION	RAW WATER PUMPS
4.4	Minimum column pipe thickness, mm	10 mm
4.5	Impeller	Super Duplex SS
4.6	Shaft/ Line Shaft	Super Duplex SS
4.7	Shaft Sleeves	Duplex SS
4.8	Shaft Coupling	Duplex SS
4.9	Wearing rings	Super Duplex SS
4.10	Wetted fasteners	Duplex SS
4.11	Fasteners (others)	SAE 1045
4.12	Gland plate	Duplex SS
4.13	Lantern Ring	Duplex SS
4.14	Intermediate stage bearings	Thordon Type / Cutless Nitrile rubber in Duplex SS Shell
4.15	Mech. seal	YES
4.16	Gland Packing (Asbestos Free)	Braided Impregnated Teflon (Asbestos Free)
4.17	Base/ Sole Plate	Duplex SS
4.18	Thrust pad	Carbon Steel with White Metal Lining
4.19	Connecting Pipe material (for deciding counterflange material)	CARBON STEEL AS PER ASTM A671 WITH RUBBER LINED
5.0	MANDATORY SPARES	
	Spares for vertical pumps (for each type and size)	
5.1	Shaft sleeves	2 Sets
5.2	Bearing of pumps (all bearings) including thrust bearing as applicable.	1 Set
5.3	Wearing rings or equivalent for impeller (if applicable)	1 Set
5.4	Wearing rings or equivalent for Casing/ Bowl (if applicable)	1 Set
5.5	Impeller Shaft and Line shafts with fasteners (as applicable)	1 Set
5.6	All shaft Couplings with fasteners (as applicable)	1 Set
5.7	Coupling between pump and motor & coupling Guards	1 Set
5.8	Bushes for the all Couplings as applicable	1 Set
5.9	Gland packing	1 Set
5.10	Thrust bearings Pads (if applicable)	2 Sets
5.11	All Gaskets	1 Set
5.12	Impeller with impeller nut	1 Set

	DATA SHEET - A	SPECIFICATION NO.: PE-TS-421-100-N001 (R01)
	MISCELLANEOUS PUMPS (Vertical Pumps)	
	2X660 MW MAITREE BANGLADESH STPP	
Sl. No.	DESCRIPTION	RAW WATER PUMPS
	C & I SPARES	
	Measuring instruments (List of measuring instruments as specified with individual system/ sub-system shall be applicable for the respective system. Spare list of measuring instruments will be governed by this clause, for system/ subsystem which are not mentioned/ specified exclusively in the list of spares.)	
	Electronic Transmitters	
5.13	Transmitters of all types, ranges and model no. (for the measurement of pressure, differential pressure flow, level etc.)	10% or minimum 1 no., whichever is more.
5.14	Electronic cards/ PCB's for each type and model of transmitters.	10% of each type.
	Temperature Elements	
5.15	RTD's	10% of each type and length or minimum 1 no., whichever is more.
5.16	Thermocouples	10% of each type and length or minimum 1 no., whichever is more.
5.17	Thermo well for above applications	10% of each type and length or minimum 1 no., whichever is more.
5.18	Temperature transmitters	10%.
	Mandatory Spare Note: 1. One set consists of quantity required for complete replacement for one pump 2. In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed as above.	
6.0	Bid Evaluation	
6.1	Bid evaluation rate	Rs.2 Lacs/KW
6.2	Maximum permissible efficiency for Bid evaluation	
6.2.1	Pump Efficiency	84
6.2.2	Motor Efficiency	94
Notes :		
1	Material of construction for other components not specified above shall be similarly selected in line with the above for the duty intended and subject to approval.	
2	For items stated as not applicable by bidder, shall have to be supplied without any cost implication to BHEL in the event they are found to be applicable during detail engineering stage.	
3	For all HT motor driven pumps (wherever applicable), bidder shall provide flat surface with dimensions 60 MM x60 MM on bearing Housing for mounting vibration measuring block and a key slots of dimensions 30MM (L) X 15 MM (W) X 3 MM (D) on each pump shaft or some other suitable location which shall be confirmed during detail engineering by BHEL for Phase Marker.	
4	Wherever SS/DSS material is coming in contact with non SS/DSS material, suitable isolation (rubber etc.) shall be provided to avoid galvanic corrosion.	
5	For Duplex SS, minimum grade is UNS 32205. Wherever duplex SS is indicated grade equivalent or superior to UNS 32205 shall be provided.	
6	Any metallic component coming in contact with water shall be Minimum Duplex SS.	

SEA WATER
ANALYSIS

SL	Sampling Location	pH Values	Temperature (°C)	NTU	EC μ s/cm	Alkalinity mg/L	p-alkalinity mg/L	m-alkalinity mg/L	Total hardness (mg/l)	TDS (mg/L)	Salinity (ppt)	TSS (mg/L)	DO (mg/l)	PO4 (mg/L)	Cl- (mg/L)	F- (mg/L)	NH4 (mg/L)	NO3 (mg/L)	NO2 (mg/L)	SO4 (mg/L)	BOD ₅ (mg/L)	COD (mg/L)
1	High tide, Passur River, Mongla, Khulna	8,1	26,9	579	353	131	0	133		170		123		0,89	51	<.10	0,30	0,78	<.016	12	12	32
2	Low tide, Passur River, Mongla, Khulna	8,1	26,7	594	409	133	0	135		197		147		1,1	66	0,10	<.10	0,83	<.016	15	18	48
	Sampling 16 August 2014																					
3	Sampling April	7,9	31						2550	13190	12,00	54	5,7	2,1				1,3		1360	3,20	376
4	Sampling July	7,1	33						175	445	2,20	90	6,8	0,45				0,76		45	3,10	28
5	Sampling October	8,1	31								0,00		7,6								4,00	
															9724							
6	Sampling 23. May 2014: Jetty Side Passur River			77		138																
SL	Sampling Location	Al (mg/L)	Ba (mg/L)	Ca (mg/L)	Fe (mg/L)	Mn (mg/L)	Mg (mg/L)	K (mg/L)	Na (mg/L)	FC (CFU)	TC (CFU)	SiO2 (mg/L)	P (mg/L)	TOC (mg/L)	DOC (mg/L)	Oil and Grease (mg/l)						
1	High tide, Passur River, Mongla, Khulna	0,85	0,107	26,75	2,0	<.05	8,7	3,9	29,11	240	460	11,7	1,2	6,25	3,93							
2	Low tide, Passur River, Mongla, Khulna	0,962	0,165	26,94	4,2	<.05	9,4	6,68	41,77	270	520	13,6	2,3	7,91	4,49							
	Sampling 16 August 2014																					
3	Sampling April															< 5						
4	Sampling July															< 5						
5	Sampling October																					
6	Sampling 23. May 2014: Jetty Side Passur River			296	0,51		737	204	8505			14,3										

3 - 5: Sampling location: Left bank of Passur River at Project Site - Jetty

SEA WATER ANALISYS

Consultancy Research and Testing Services (CRTS)
Department of Civil Engineering, Khulna University of Engineering & Technology

Test Results on Water Quality and Sedimentation Characteristics of Possur River at Intake Point (BIFPCL, Rampal)

Date	High Tide							Low Tide						
	Time	pH	Tur (NTU)	Elec Con (EC) mS/cm	Sedimentation (ml/L)			Time	pH	Tur (NTU)	Elec Con (EC) mS/cm	Sedimentation (ml/L)		
					30min	60min	120min					30min	60min	120min
17.01.15	1100	7.87	103	5.40	-	-	-	1730	7.78	63.5	5.25	-	-	-
18.01.15	1150	8.03	170	3.28	0.05	0.20	0.35	1830	8.03	49.5	1.80	Nil	Nil	Nil
19.01.15	1245	7.86	315	5.24	-	-	-	750	7.90	323	4.88	-	-	-
20.01.15	1330	7.90	178	5.38	0.10	0.25	0.35	830	7.90	208	4.53	0.15	0.35	0.50
21.01.15	1400	7.84	382	5.64	-	-	-	900	7.90	172	5.00	-	-	-
22.01.15	1450	7.86	337	5.50	0.45	0.60	0.70	940	7.84	239	4.94	0.15	0.25	0.40
23.01.15	1540	7.84	202	5.19	-	-	-	1020	7.84	108	5.14	-	-	-
24.01.15	1630	7.62	504	5.96	-	-	-	1050	7.41	92.7	6.24	-	-	-
25.01.15	1715	7.73	311	5.90	-	-	-	1130	7.78	144	5.85	-	-	-
26.01.15	1810	7.85	633	5.77	-	-	-	1210	7.82	299	5.49	-	-	-
27.01.15	1820	7.81	289	5.35	0.05	1.50	2.00	1300	7.85	635	5.66	1.50	3.50	5.00
28.01.15	720	7.86	332	5.47	-	-	-	1320	7.81	653	5.64	-	-	-
29.01.15	830	7.87	386	5.80	-	-	-	1500	7.86	101	5.67	-	-	-
30.01.15	1000	7.90	360	5.73	-	-	-	1630	7.89	258	11.44	-	-	-
31.01.15	1110	7.94	400	11.54	-	-	-	1745	7.97	132	9.22	-	-	-

SEA WATER ANALYSIS

A water analysis from the area adjacent to the site giving salinity and water quality is shown below:

loc ati on	Date	Tem p.	pH	EC	Cl	T. Alkal inity	Turbid ity	T S	TDS	SS	DO	BOD	COD	Sal inity
		°C		µS/cm	mg/l	mg/l	NTU	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
1	7-Jan	27.4	7.74	3010	879	36	68.7	1565	1510	55	5.1	0.8	55	1.6
2	7-Jan	27.1	7.72	3020	878.8	36	68.5	1570	1510	60	5.1	0.8	55	1.6
3	7-Jan	27.8	7.71	3030	879	36	68.8	1565	1510	55	5.1	0.8	55	1.6
1	11-Feb	29.8	7.66	4380	1262	36	182	2390	2180	210	4.7	1	76	2.3
2	11-Feb	29.2	7.63	4380	1268	36	178	2390	2190	200	4.7	1	76	2.3
3	11-Feb	29.1	7.65	4380	1263	36	179	2380	2180	200	4.7	1	76	2.3
1	9-Mar	32.6	7.56	11780	2944.4	38	176	6080	5890	190	4.7	1.2	76	6.7
2	9-Mar	32.6	7.57	11780	2945.2	38	178	6080	5890	190	4.7	1.2	76	6.7
3	9-Mar	32.1	7.55	11780	2946.4	38	177	6090	5890	200	4.7	1.2	76	6.7
1	17-Apr	32.6	7.59	25300	8273	36	185.6	12950	12700	250	4.6	0.7	136	15.5
2	17-Apr	32.6	7.59	25300	8273	36	186.2	12950	12700	250	4.6	0.7	138	15.5
3	17-Apr	32.6	7.59	25300	8273	36	184.8	12950	12700	250	4.6	0.7	136	15.5
1	5-May	32.6	7.59	29200	9480	36	198.6	14900	14600	300	4.5	1.2	177	17.6
2	5-May	32.9	7.54	29200	9470	36	198.6	14900	14600	300	4.4	1.2	177	17.6

Figure 1 Water quality of the Passur River at Mongla point
(Source: EIA-Report)

SEA WATER ANALISYS

loc ati on	Date	Tem P- °C	pH	EC µS/cm	Cl mg/l	T. Alkal inity mg/l	Turbid ity NTU	T S mg/l	TDS mg/l	SS mg/l	DO mg/l	BOD mg/l	COD mg/l	Sal inity mg/l
3	5-May	33.2	7.57	29200	9470	36	199.6	14900	14600	300	4.5	1.2	177	17.6
1	13-Jun	31.6	7.69	18000	5820	36	112.6	9200	9000	200	4.7	1.1	97	10.8
2	13-Jun	31.6	7.69	18000	5800	36	113.2	9200	9000	200	4.7	1.1	97	10.8
3	13-Jun	31.6	7.69	18000	5810	36	112.4	9200	9000	200	4.7	1.1	97	10.8
1	1-Jul	31.6	7.69	440	32.6	36	76.6	285	220	65	5.2	0.8	26	-
2	1-Jul	31.6	7.69	440	32.6	36	76.6	285	220	65	5.2	0.8	26	-
3	1-Jul	31.6	7.69	440	32.6	36	76.6	285	220	65	5.2	0.8	26	-
1	5-Aug	31.6	7.69	275	16.6	36	68.6	192	137	55	5.3	0.7	22	-
2	5-Aug	31.6	7.69	275	16.6	36	68.6	192	137	55	5.3	0.7	22	-
3	5-Aug	31.6	7.69	275	16.6	36	68.6	192	137	55	5.3	0.7	22	-
1	8-Sep	31.6	7.74	270	15.6	36	65.6	180	135	45	5.5	0.7	22	-
2	8-Sep	31.6	7.76	270	15.6	36	65.6	180	135	45	5.5	0.7	22	-
3	8-Sep	31.6	7.74	270	15.6	36	65.6	180	135	45	5.5	0.7	22	-
1	12-Oct	30.6	7.79	290	26.6	36	62.6	192	145	47	5.6	0.7	22	-
2	12-Oct	30.6	7.78	290	26.6	36	62.6	192	145	47	5.6	0.7	22	-
3	12-Oct	30.6	7.78	290	25.6	36	62.6	192	145	47	5.6	0.7	22	-
1	5-Nov	24.6	7.79	340	38.6	36	56.6	210	170	40	5.6	0.7	22	-
2	5-Nov	26.6	7.79	340	38.6	36	56.6	210	170	40	5.6	0.7	22	-
3	5-Nov	25.6	7.79	340	38.6	36	56.6	210	170	40	5.6	0.7	22	-
1	12-Dec	21.5	7.72	520	62.6	36	72.6	320	260	60	5.1	0.9	25	0.4
2	12-Dec	20.9	7.71	520	62.6	36	73.6	320	260	60	5.1	0.9	25	0.4
3	12-Dec	21.1	7.72	520	62.6	36	71.6	320	260	60	5.1	0.9	25	0.4

Figure 2 Water quality of the Passur River at Mongla point
(Source: EIA-Report)



TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-421-100-N001**

SECTION: **II**

SUB-SECTION: **IIA**

REV. NO. **0** DATE **14/03/18**

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SUB-SECTION - IIA

STANDARD TECHNICAL SPECIFICATION (MECHANICAL)

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

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

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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.		

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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.			



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STANDARD TECHNICAL SPECIFICATION
VERTICAL PUMPS

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

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

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

3.05.00 Works excluded from Bidder's Scope:

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

4.00.00 BID EVALUATION CRITERIA & LIQUIDATED DAMAGES FOR SHORTFALL:

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

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

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

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

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

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



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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.

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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.		

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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.		



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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.



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- 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.

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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.		

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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.		



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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



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

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

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

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

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

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

9.08.00 **Reverse Rotation**

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

9.09.00 **Drive Unit**

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

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

- a) 16% margin over the pump shaft input power at the rated duty point.
- b) 10% margin over the maximum pump shaft input power required within the 'Range of Operation'.
- c) Pump shaft input power required considering the overloading of the pump assuming



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

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

10.00.00 **INSPECTION AND TESTING**

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

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

a) **Identification and Testing**

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

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

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

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

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



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- 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

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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.		



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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.



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DATA SHEET – C

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

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

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



BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN

Rev-01

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

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



BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN

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

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

Rev-01

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

NAME SIGN. DATE	Prepared By	Reviewed By	Approved By
	AJAY JAIN	ASHWANI KHANNA	I. J. SINGH
	<i>[Signature]</i> 23-07-2012	<i>[Signature]</i> 23-07-2012	<i>[Signature]</i> 23-07-2012



BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN

Rev-01

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

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



BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN

Rev-01

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

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



BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
STANDARD QUALITY PLAN

Rev-01

QUALITY PLAN FOR MISCELLANEOUS PUMPS				CUSTOMER		PROJECT TITLE				
				BIDDER/VENDOR		QUALITY PLAN NUMBER				
SHEET 6 OF 6				SYSTEM		ITEM - CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL)				

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

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

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

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

P- PERFORM, W- WITNESS, V-VERIFICATION

BHEL	PARTICULARS	BIDDER / VENDOR
	NAME	
	SIGNATURE	
	DATE	

BIDDER/VENDOR SEAL

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

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPEC. NO.: **PE-TS-421-100-N001**

SECTION: **III**

SUB-SECTION:

REV. NO. **0** DATE 14/03/18

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

SECTION III

DOCUMENTS TO BE SUBMITTED BY BIDDER



TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPEC. NO.: **PE-TS-424-100-N001** R01

SECTION: **IIIA**

SUB-SECTION:

REV. NO. **0** DATE 05/03/19

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

SECTION IIIA

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

**SCHEDULE OF PERFORMANCE GUARANTEES****2 x 660 MW MAITREE BANGLADESH**

SPECN. NO.:

PE-TS-421-100-N001, Rev-1

VOLUME:

--

SECTION:

IIIA

Sheet 1 of 1

REV. NO.

00

DATE:

05-03-2019

Following parameters are guaranteed for following pumps

Sl. No.	Pump Description	Guaranteed Capacity	Guaranteed TDH	Guaranteed Pump Eff.	Guaranteed Motor Eff.	Guaranteed Power consumption at inlet to motor terminals	Pump model	TDH (as per note-2 below)	Motor Rating	MOTOR GD ² Value for HT motor only	Pump RPM	T/S characteristics & GD2 of pump checked with same for HT motor
		(M3/Hr)	(MWC)	%	%	(KW)		(MWC)	(KW)			
	VERTICAL PUMPS											
1	# RAW WATER PUMPS	1820	37		94				275	19.2	1485	YES

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

2 TDH for pump w.r.t. clause 1.10 of Section IA for selection of motor rating.

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.

It is also confirm that HT motor details (rating, RPM, GD2 value, TS curve etc) have been noted and offered pump is suitable for the details of HT motor.

PARTICULARS OF BIDDER/ AUTHORISED REPRESENTATIVE

NAME

DESIGNATION

SIGNATURE

DATE

COMPANY SEAL



TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPEC. NO.: **PE-TS-421-100-N001** R01

SECTION: **IIIB**

SUB-SECTION:

REV. NO. **0** DATE 05/03/19

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

SECTION IIIB

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

	TECHNICAL SPECIFICATION	SPECIFICATION NO.:		PE-TS-421-100-N001, Rev.1	
	MISCELLANEOUS PUMPS COMPLIANCE CERTIFICATE	VOLUME:		SECTION:	IIIB
		REV. NO.	0	DATE:	05-03-2019

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

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

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

Any mandatory spares stated as not applicable, shall have to be supplied without any cost implication to BHEL in the event they are found to be applicable during detail engineering stage.
- The offered materials should be either equivalent or superior to those specified. Also for components where material is not specified it shall be suitable for intended duty. All materials shall be subject to approval in the event of order.
- Prices for recommended spares (if any) for 3 years operation shall be furnished separately & not included in the base price.
- The commissioning spares (if any) are supplied on 'As Required Basis' & prices for same included in the base price (If bidders reply to this is "No commissioning spares are required" and if some spares are actually required during commissioning same shall be supplied by bidder without any cost to BHEL).
- All sub vendors shall be as per BHEL/CONSULTANT/CUSTOMER approved list.
- Tests for noise, vibration, parallel running etc. for pumps shall be conducted at site by Pump Vendor/BHEL as per cl. no. 3.04.00 of Section-IIA and if the site performance is found not meeting the requirements in any respect as specified, then the equipment shall be rectified or replaced by the vendor, at his own cost.
- Any special tools & tackles, if required, shall be in bidder's scope.
- All models offered have been supplied by bidder in the past and are meeting the experience qualifying criteria of BHEL/CONSULTANT/CUSTOMER (viz. offered model is successfully operating in two separate stations for at least one year or as specified in technical PQR). Any deviation to this criteria shall be suitably highlighted in deviation schedule.
- All selected motor ratings have minimum margins as per Datasheet A, Section ID & as per clause no 1.10 of section-IA.
- Indian Standards and Chinese Standards are NOT acceptable. Wherever international standards have been mentioned same shall not include Indian and Chinese standards.
- Wherever 'IS' code is indicated in this specification, equivalent international code is to be used inline with the above.

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

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



TITLE:

**TECHNICAL SPECIFICATION
MISCELLANEOUS PUMPS**

SPEC. NO.: **PE-TS-424-100-N001**

SECTION: **IIID**

SUB-SECTION:

REV. NO. **0** DATE 12/10/17

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

SECTION IIID

DATA SHEET – B FOR PUMPS

~~**ELECTRICAL LOAD DATA FORMAT**~~

~~**CABLE SCHEDULE**~~

~~**MOTOR DATASHEET-C**~~

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

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

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

	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				