SCHEDULE OF PRICES - MISC PUMPS VERTICAL						
2X800 MW LARA STPP STAGE-II						
	DESCRIPTION OF WORKS OR EQUIPMENT(S)	UOM	QUANTITY	UNIT EX-WORKS PRICE INCLUDING PACKING (INR)	TOTAL EX-WORKS PRICE INCLUDING PACKING (INR)	
	Total Price for design, manufacture, assembly, inspection and testing at manufacturer's and/or his sub-contractors works, painting, proper packing to avoid damage of items during transportation & storage at site of Miscellaneous Pumps (along with Motors & mandatory spares as applicable), transportation to site, complete with all other accessories as per the requirements specified in the specification, site services including installation checks of pump motor set at site, PG Test at site and any other services, etc. as per specification PE-TS-508/512-100-W002, REV-00 for Misc. Pumps Vertical of 2X800 MW LARA STPP STAGE-II.					
1.0	**Pumps and Motors (Vertical Pumps):**					
	(i) RAW WATER (PT) PUMPS					
	Pump price:	Nos.	3			
	Motor price:	Nos.	BHEL SCOPE			
	Forced Water Lubrication System	Set	1			
	Mandatory Spares (as per Annexure -A)	Lot	1			
	(ii) RAW WATER (ASH) PUMPS					
	Pump price:	Nos.	3			
	Motor price:	Nos.	3			
	RE Joint:	Nos.	3			
	Forced Water Lubrication System	Set	1			
	Mandatory Spares (as per Annexure -A)	Lot	1			
2.0	**SITE SERVICES:**					
2.1	**Installation Check (For all Pumps) at Site as per Specification**					
2.1.1	Site Visit Charges	Nos. of Visits	6			
2.1.2	Manday Charges at Site	Nos. of Mandays	18			
2.2	**Lumpsum cost for PG Test of pumps at site as per Specification**	Lot	1			
	TOTAL (1.0+ 2.0)					

NOTES:

a)	Service charges at Sl.no 2.1.1. shall include to/fro travel expenses, medical and insurance.
b)	Service Charges at Sl.no 2.1.2. shall include boarding/lodging, local conveyance or any other applicable charge for completion of site services. No. of mandays at site defined at Sl.no. 2.1.2 above shall be calculated on the basis of presence at site (travelling time/days is excluded).
c)	Payment for Sl. No. 2.1 shall be done based on actual consumed site visits and mandays.
d)	Price of commissioning & erection spares, special Tools & tackle and other accessories not listed above shall be included in the price of pump & shall be supplied with the pump.
e)	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.
f)	Please refer technical specification for detail.
g)	Mandatory Spare Note: 1. One(1) set consists of quantity required for complete replacement for one(1) Pump of each type/size. Also the 'set' would include all components/hardware required to replace the item. 2. Bidder shall not indicate "Not Applicable" against any of the spare (except for those items for which "if applicable" is specified). In case of not applicability, functionally equivalent spare to be mentioned with price in the relevant price schedules. Bidder shall not mention any remark other than price value in relevant

Bidder shall furnish this price Schedule indicating "Quoted" against each item along with his technical offer and actual prices in his price offer.

SCHEDULE OF PRICES -ANNEXURE-A
MANDATORY SPARES OF MISC. PUMPS (VERTICAL)
2X800 MW LARA STPP STAGE-II

S. NO.	ITEM DESCRIPTION		MANDATORY SPARE LIST	QUANTITY	UNIT EX-WORKS PRICE INCLUDING PACKING (INR)	TOTAL EX-WORKS PRICE INCLUDING PACKING (INR)
1.0	**MANDATORY SPARES PRICES-MISC PUMPS (VERTICAL)**					
1.1	Raw Water (PT) Pumps	**1.1.1**	Impeller with nuts & washers	1 set		
		1.1.2	Bearings for Line, Head and Impeller shafts	1 set		
		1.1.3	Thrust Bearings of pump & drive	1 set		
		1.1.4	Wearing rings – Impeller (if applicable)	1 set		
		1.1.5	Wearing rings – Casing (if applicable)	1 set		
		1.1.6	Gland, packing & gland assembly	1 set		
		1.1.7	Impeller Shaft, line shaft and head shaft	1 set		
		1.1.8	Shaft Sleeves	1 set		
		1.1.9	Stuffing box	1 set		
		1.1.10	Pump & Drive Coupling, bushes, pins with all fasteners & coupling guards (as applicable)	1 set		
		1.1.11	All Gaskets	1 set		
		1.1.12	Line Shaft Couplings (if applicable)	1 set		
		Spares for Lubrication Water Pumps				
		1.1.13	Impeller with nuts and other accessories	1 set		
		1.1.14	Impeller Shaft with fasteners	1 set		
		1.1.15	Shaft Sleeves	1 set		
		1.1.16	Wearing rings – Impeller (if applicable)	1 set		
		1.1.17	Wearing Rings – Casing (if applicable)	1 set		
		1.1.18	Pump bearings	1 set		
		1.1.19	Thrust bearings	1 set		
		1.1.20	Pump & Drive Coupling compl. assy. & coupling Guards	1 set		
		1.1.21	Pump to drive coupling bushes with fasteners	1 set		
		1.1.22	Gland, Packing & Gland Assembly / Mech. seal as applicable	1 set		
		1.1.23	Motor for Lubrication Water Pumps	1 No		
		C&I Spares (If Applicable)				
		1.1.24	Transmitters of all types and model. (for the measurement of Pressure, differential pressure, flow, level, etc.) including local indication (if applicable)	2 Nos. of each type and model.		
		1.1.25	RTD'S	1 no. of each type		
		1.1.26	Pressure gauges	1 no. of each range and type		
		1.1.27	Differential Pressure Gauges,	1 no. of each range and type		
		1.1.28	All types of Rota meters	1 no. of each range		
		1.1.29	Process Actuated Switch Devices -As applicable for this package, as per the following items			
		1.1.29 (a)	Flow switches	1 no. of each range and type		
		1.1.29 (b)	Solenoid Valves	2 nos. of each type, model and rating.		

		1.1.30	Electric Actuators	1 no. of each type, class, size and model whichever is more.		
1.2	Raw Water (Ash) Pumps	**1.2.1**	Impeller with nuts & washers	1 set		
		1.2.2	Bearings for Line, Head and Impeller shafts	1 set		
		1.2.3	Thrust Bearings of pump & drive	1 set		
		1.2.4	Wearing rings – Impeller (if applicable)	1 set		
		1.2.5	Wearing rings – Casing (if applicable)	1 set		
		1.2.6	Gland, packing & gland assembly	1 set		
		1.2.7	Impeller Shaft, line shaft and head shaft	1 set		
		1.2.8	Shaft Sleeves	1 set		
		1.2.9	Stuffing box	1 set		
		1.2.10	Pump & Drive Coupling, bushes, pins with all fasteners & coupling guards (as applicable)	1 set		
		1.2.11	All Gaskets	1 set		
		1.2.12	Motor and Motor Bearings	1 set		
		1.2.13	Line Shaft Couplings (if applicable)	1 set		
		Spares for Lubrication Water Pumps				
		1.2.14	Impeller with nuts and other accessories	1 set		
		1.2.15	Impeller Shaft with fasteners	1 set		
		1.2.16	Shaft Sleeves	1 set		
		1.2.17	Wearing rings – Impeller (if applicable)	1 set		
		1.2.18	Wearing Rings – Casing (if applicable)	1 set		
		1.2.19	Pump bearings	1 set		
		1.2.20	Thrust bearings	1 set		
		1.2.21	Pump & Drive Coupling compl. assy. & coupling Guards	1 set		
		1.2.22	Pump to drive coupling bushes with fasteners	1 set		
		1.2.23	Gland, Packing & Gland Assembly / Mech. seal as applicable	1 set		
		1.2.24	Motor for Lubrication Water Pumps	1 No		
		C&I Spares (If applicable)				
		1.2.25	Transmitters of all types and model. (for the measurement of Pressure, differential pressure, flow, level, etc.) including local indication (if applicable)	2 Nos. of each type and model.		
		1.2.26	Pressure gauges	1 no. of each range and type		
		1.2.27	Differential Pressure Gauges,	1 no. of each range and type		
		1.2.28	All types of Rota meters	1 no. of each range		
		1.2.29	Process Actuated Switch Devices -As applicable for this package, as per the following items			
		1.2.29 (a)	Flow switches	1 no. of each range and type		
		1.2.29 (b)	Solenoid Valves	2 nos. of each type, model and rating.		
		1.2.30	Electric Actuators	1 no. of each type, class, size and model whichever is more.		

SCHEDULE OF PRICES - MISC PUMPS VERTICAL 2X800 MW SINGRAULI STPP STAGE-III							
	DESCRIPTION OF WORKS OR EQUIPMENT(S)				UOM	QUANTITY	UNIT EX-WORKS PRICE INCLUDING PACKING (INR)	TOTAL EX-WORKS PRICE INCLUDING PACKING (INR)
	Total Price for design, manufacture, assembly, inspection and testing at manufacturer's and/or his sub-contractors works, painting, proper packing to avoid damage of items during transportation & storage at site of Miscellaneous Pumps (along with Motors & mandatory spares as applicable), transportation to site, complete with all other accessories as per the requirements specified in the specification, site services including installation checks of pump motor set at site, PG Test at site and any other services, etc. as per specification PE-TS-508/512-100-W002, REV-00 for Misc. Pumps Vertical of 2X800 MW SINGRAULI STPP STAGE-III.							
1.0	**Pumps and Motors (Vertical Pumps):**							
	(i)	**AUX. CT PUMPS**						
			Pump price:		Nos.	4		
			Motor price:		Nos.	BHEL SCOPE		
			Forced Water Lubrication System		Set	1		
			Mandatory Spares (as per Annexure -A)		Lot	1		
2.0	**SITE SERVICES:**							
2.1	**Installation Check (For all Pumps) at Site as per Specification**							
2.1.1	Site Visit Charges				Nos. of Visits	4		
2.1.2	Manday Charges at Site				Nos. of Mandays	16		
2.2	**Lumpsum cost for PG Test of pumps at site as per Specification**				Lot	1		
	TOTAL (1.0+ 2.0)							

NOTES:

a)	Service charges at Sl.no 2.1.1. shall include to/fro travel expenses, medical and insurance.
b)	Service Charges at Sl.no 2.1.2. shall include boarding/lodging, local conveyance or any other applicable charge for completion of site services. No. of mandays at site defined at Sl.no. 2.1.2 above shall be calculated on the basis of presence at site (travelling time/days is excluded).
c)	Payment for Sl. No. 2.1 shall be done based on actual consumed site visits and mandays.
d)	Price of commissioning & erection spares, special Tools & tackle and other accessories not listed above shall be included in the price of pump & shall be supplied with the pump.
e)	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.
f)	Please refer technical specification for detail.
g)	Mandatory Spare Note: 1. One(1) set consists of quantity required for complete replacement for one(1) Pump of each type/size. Also the 'set' would include all components/hardware required to replace the item. 2. Bidder shall not indicate "Not Applicable" against any of the spare (except for those items for which "if applicable" is specified). In case of not applicability, functionally equivalent spare to be mentioned with price in the relevant price schedules. Bidder shall not mention any remark other than price value in relevant

Bidder shall furnish this price Schedule indicating "Quoted" against each item along with his technical offer and actual prices in his price offer.

SCHEDULE OF PRICES -ANNEXURE-A
MANDATORY SPARES OF MISC. PUMPS (VERTICAL)
2X800 MW SINGRAULI STPP STAGE-III

S. NO.	ITEM DESCRIPTION		MANDATORY SPARE LIST	QUANTITY	UNIT EX-WORKS PRICE INCLUDING PACKING (INR)	TOTAL EX-WORKS PRICE INCLUDING PACKING (INR)
1.0	**MANDATORY SPARES PRICES-MISC PUMPS (VERTICAL)**					
		1.1.1	Impeller with nuts & washers	1 set		
		1.1.2	Bearings for Line, Head and Impeller shafts	1 set		
		1.1.3	Thrust Bearings of pump & drive	1 set		
		1.1.4	Wearing rings – Impeller (if applicable)	1 set		
		1.1.5	Wearing rings – Casing (if applicable)	1 set		
		1.1.6	Gland, packing & gland assembly	1 set		
		1.1.7	Impeller Shaft, line shaft and head shaft	1 set		
		1.1.8	Shaft Sleeves	1 set		
		1.1.9	Stuffing box	1 set		
		1.1.10	Pump & Drive Coupling, bushes, pins with all fasteners & coupling guards (as applicable)	1 set		
		1.1.11	All Gaskets	1 set		
		1.1.12	Line Shaft Couplings (if applicable)	1 set		
		Spares for Lubrication Water Pumps				
		1.1.13	Impeller with nuts and other accessories	1 set		
		1.1.14	Impeller Shaft with fasteners	1 set		
		1.1.15	Shaft Sleeves	1 set		
		1.1.16	Wearing rings – Impeller (if applicable)	1 set		
		1.1.17	Wearing Rings – Casing (if applicable)	1 set		
		1.1.18	Pump bearings	1 set		
		1.1.19	Thrust bearings	1 set		
		1.1.20	Pump & Drive Coupling compl. assy. & coupling Guards	1 set		
		1.1.21	Pump to drive coupling bushes with fasteners	1 set		
1.1	AUX. CT PUMPS	**1.1.22**	Gland, Packing & Gland Assembly / Mech. seal as applicable	1 set		
		1.1.23	Motor for Lubrication Water Pumps	1 No		
		C&I Spares				
		1.1.24	Transmitters of all types and model. (for the measurement of Pressure, differential pressure, flow, level, etc.) including local indication (if applicable)	2 Nos. of each type and model.		
		1.1.25	RTD'S	1 no. of each type		
		1.1.26	Pressure gauges	1 no. of each range and type		
		1.1.27	Differential Pressure Gauges,	1 no. of each range and type		
		1.1.28	Flow gauges excluding Rota meters (if applicable)	1 no. of each range and type		
		1.1.29	All types of Rota meters (if applicable)	1 no. of each range		
		1.1.30	Process Actuated Switch Devices -As applicable for this package, as per the following items			
		1.1.30 (i)	Flow switches	1 no. of each range and type		
		1.1.30 (ii)	Solenoid Valves	2 nos. of each type, model and rating.		
		1.1.30 (iii)	Limit Switches (for Pneumatic Valves and Manual valves)	2 nos. of each type		
		1.1.31	Electric Actuators -As applicable for this package, as per the following items			
		1.1.31 (i)	Electric Actuators	1 no. of each type, class, size and model whichever is more.		
		1.1.31 (ii)	Electronic PCB of all types	(10% of each type & model)		
		1.1.31 (iii)	Absolute Encoder (replaceable part)	(5% of each type & model)		
		1.1.31 (iv)	Electronic Torque sensoR	(5% of each type & model)		

2X800 MW LARA STPP STAGE-II
&
2X800 MW SINGRAULI STPP STAGE-III

Customer: NTPC

TECHNICAL SPECIFICATION

FOR

MISC. PUMPS (VERTICAL)

SPECIFICATION No. **PE-TS-508/512-100-W002**

REV NO. 00

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA

INDEX

	TECHNICAL SPECIFICATION MISC. PUMPS (VERTICAL) 2X800 MW LARA STAGE-II & 2X800 SINGRAULI STAGE-III	PE-TS-508/512-100-W002 Rev. No. 00 Date : 14.08.25

PROJECT INFORMATION

SL.NO	DESCRIPTION	2x800 MW LARA	2x800 MW SINGRAULI
1	**METEOROLOGICAL DATA**		
1.1	MAXIMUM TEMPERATURE	48.3 Deg C	48.8 Deg C
1.2	MINIMUM TEMPERATURE	6.4 Deg C	1.0 Deg C
1.3	MAXIMUM RELATIVE HUMIDITY	84%	83%
1.4	MINIMUM RELATIVE HUMIDITY	22%	21%
1.5	AVERAGE ANNUAL RAINFALL	1429.3	1199.5
2	**ELECTRICAL DATA**		
2.1	AMBIENT TEMPERATURE FOR DESIGN OF ELECTRICAL EQUIPMENT	50 Deg C	50 Deg C
2.2	RATED FREQUENCY	refer part A of spec.	refer part A of spec.
2.3	FREQUENCY VARIATION		
2.4	AC VOLTAGE		
2.5	AC VOLTAGE VARIATION		
2.6	DC VOLTAGE		
2.7	DC VOLTAGE VARIATION		
2.8	FAULT LEVEL (KA/SEC)		

	TECHNICAL SPECIFICATION MISC. PUMPS (VERTICAL) 2X800 MW LARA STAGE-II & 2X800 SINGRAULI STAGE-III	PE-TS-508/512-100-W002 Rev. No. 00 Date : 14.08.25

	GENERAL TECHNICAL REQUIREMENT
1	The design, manufacture and testing of the Pumps complete with all accessories, shall generally conform to the latest editions of the appropriate standards.
2	The bidder to choose a standard proven model from the range of pumps manufactured.
3	The equipment shall comply with all applicable safety codes and statutory regulations of India where the equipment is to be installed.
4	Latest codes and standards shall be applicable as on date of bid submission.
5	In the event of any conflict between the requirements of two clauses of this specification, documents or requirements of different codes and standards specified, stringent requirement as per the interpretation of the owner/BHEL shall apply.
6	Drawing / documents to be submitted by bidder shall be as per "Documentation Requirement" given in this specification.
7	Bidder to note that drawing/document submission shall be through web based Document Management System. Bidder shall be provided access to the DMS for drg/doc approval and adequate training for the same. Bidder to ensure proper net connectivity at their end.
8	The first revision drawings/ documents submitted by vendor shall be complete in all respects. Any incomplete drawing submitted shall be treated as non- submission with delays attributable to vendor’s account. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL / Customer’s place as per the requirement for across the table submissions/ discussions/ finalizations of drawings.
9	The details of the Pumps with the quantity, design parameters, accessories etc. to be supplied shall be as per Data Sheet enclosed in this specification.
10	Any accessory/component which is not specifically mentioned but required for proper performance and safe & trouble free operation of pumps and drives to be provided without any cost implication to BHEL.
11	Pumps shall be of vertical shaft, complete with bowl, column pipe, discharge head and base plate with all required accessories mentioned in Specification.
12	Pumps of a particular category shall be identical and shall be suitable for parallel operation with equal load division. 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.
13	Components of identical pumps shall be interchangeable.
14	The pumps shall be capable of running over the entire range of submergence/ NPSH conditions required without any noise, vibration or cavitations.
15	Selection of the pumps shall be such that the design point shall be met even with negative manufacturing tolerance.

16	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 TECHNICAL DATA - PART - A.
17	The pump impeller and other rotating components shall be designed for reverse rotation, when subject to reverse flow.
18	All Vertical pump motors shall be designed/capable of withstanding max. run away speed during reverse flow through pump.
19	The materials of construction for various components specified are the minimum requirements. Equivalent or Superior materials suitable for fluid handled is also acceptable subject to Customer/BHEL approval. Materials of construction for other components not specified shall be similarly selected by the bidder for the intended duty and subject to Customer/BHEL approval.
20	Wherever SS material is coming in contact with non SS material, suitable isolation (rubber etc.) shall be provided to avoid galvanic corrosion.
21	The pumps shall be capable of starting with discharge valve fully open and close condition.
	BOWL ASSEMBLY
22	Pumps will be either a single or multi-stage centrifugal, mixed flow or axial flow type with discharge co-axial with shaft as mentioned in TECHNICAL DATA - PART - A. Type of impeller shall be chosen on the basis of the pump specific speed and the characteristics of handling fluid or as mentioned in TECHNICAL DATA - PART - A.
23	Pumps 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.
	DISCHARGE HEAD
24	Pump Discharge Head shall be provided with a connection for discharge pressure Gauge as standard feature.
	COLUMN PIPE
25	Column pipe shall be flanged and of bolted connection. Column pipes shall be designed for full internal vacuum.
26	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.
	IMPELLER SHAFT, LINE SHAFT & HEAD SHAFT
27	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 shall be selected on the basis of maximum torque to be applied on the pump shaft with sufficient margin as per vendor's proven practice. Shaft size selected must also take into consideration the critical speed as specified in API-610. The critical speed shall be at least 30% higher than the rated speed.

28	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.
29	The Impeller assembly shall be dynamically balanced and designed with critical speed substantially above the operating speed.
30	Line shaft may be single or multiple pieces as required. In case of multiple pieces, line shaft shall be coupled as per the standard & proven practice of the manufacturer. For screwed coupling, directions shall permit tightening of the joint during pump operation.
31	Replaceable shaft sleeves shall be furnished at applicable location, particularly under stuffing box and at other locations, as considered necessary.
	WEARING RING
32	Replaceable type wearing rings (as applicable) shall be provided to prevent damage to impeller and casing.
	BEARINGS
33	Pump Bearing Lubrication shall be as specified in TECHNICAL DATA PART-A. For self-water lubricated Bearing, 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.
34	If water handled by pump is sea water/ dirty /not suitable for lubrication/ cooling, the bearing lubrication/cooling may be specifically reviewed by bidders for the suitability with water analysis enclosed with Specification. Such pumps shall necessarily be provided with Thordan type line shaft bearings even if the other type of bearings are claimed suitable by the manufacturers. The bidder 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 below without any cost implication.
35	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. The thrust bearing shall be rated for continuous operation with thrust as developed in shutoff condition with clearance between the wearing rings in worn out condition to be at least four (4) times the clearance between the wearing rings in new condition. 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 BHEL/Customer).

36	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. Temperature Measuring Instrument to be provided by Bidder as indicated in TECHNICAL DATA - PART - A.
37	Cooling of the thrust bearing/line shaft bearing, if necessary, shall be done by self water/external water, depending on the fluid handled (based upon water quality provided with specification) and as mentioned in TECHNICAL DATA - PART - A. In case, external water is required for forced water lubrication system by Bidder but not mentioned exclusively by BHEL, Bidder to inform in schedule of deviation at bid submission stage only.
38	In the event, Forced water lubrication is envisaged by the bidder based upon water quality or being asked in Specification in TECHNICAL DATA - PART - A, One set of common water lubrication system shall be provided separately for each type of subject pumps or common for all type of subject pumps placed in same Pump House with requirement as indicated in TECHNICAL DATA - PART - A. The lubricating system shall provide continuous lubrication to all the subject pumps during operation.
39	Minimum requirements for Forced Water Lubrication system as indicated in the TECHNICAL DATA - PART - A or P&ID attached in Specification to be provided by the Bidder. The O/H tank in RCC construction (located at the roof of Control Room, Refer attached Mech. GA of respective Pump House) along with its level measuring instruments for forced water lubrication system shall be provided by BHEL. Bidder to provide set of Lubrication Pumps along with motor, Strainers, valves and instruments as per attached P&ID of Plant Water System. In the absence of Forced water Lubrication details being provided elsewhere in specification, following minimum requirements to be provided by Bidder for each set of Lubrication system:
39.1	2X100 % duty Manual Basket Strainer / self cleaning strainers as indicated in TECHNICAL DATA - PART - A, of suitable size and mesh opening shall be provided on the common pump discharge.
39.2	2X100 % duty horizontal centrifugal lubricating pumps shall be provided. TDH of lubricating pumps to be selected considering the shut off head of the subject pumps. 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 tank as explained above.

39.3	Associated piping, fittings, Tank inlet motor operated valve, lubricating pumps suction & discharge isolating valves, motorised/ solenoid valves (as per BHEL/Customer approval), lubricating pumps discharge check valves and lubricating pipe isolating valve at inlet to each of subject pump, etc. as required shall be provided.
39.4	Instrumentation – Level Gauge for tank, pressure gauges at suction & discharge of each lubricating water pumps, pressure transmitter on lubricating pipe at inlet header for start interlock, pressure transmitter on lubricating pipe at common discharge of subject pump for start up of stand by pump etc., as required subject to BHEL/Customer approval shall be provided.
39.5	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.
39.6	Design and Construction Features, criteria for motor rating selection, operating range, MOC etc shall be same as indicated for Main pumps indicated in Datasheet-A.
39.7	The complete forced water lubrication as above – if applicable, shall be in bidder's scope. 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.
40	Line shaft bearings which are above minimum water level shall be of 'Thordon' type. For other line shaft bearings located below minimum water level, cutless rubber bearings can be used.
41	Provision on Thrust Bearing Housing for mounting temperature measuring instruments to be provided.
42	**Instructions for HT/LT Motors supplied by BHEL as free issue (with scope mentioned in TECHNICAL DATA - PART - A):**
42.1	All HT /LT motors which are not in bidder's scope of supply: only bare motors, shall be supplied as free issue by 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.
42.2	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 to Bidder's Works/Shop. Bidder shall dispatch this Job Motor to Project Site along with the Pumps at their cost. All other motors shall be dispatched by BHEL directly to project sites.

43	**SITE SERVICES:** (i) The pumps erected by BHEL shall be checked by the bidder for correctness of their installation, alignment, etc. at site prior to their commissioning. Signed Checklist for installation after completion of the activity to be submitted as per format given with specification. (ii) Performance test of Pumps at Site shall be applicable for Pumps as mentioned in TECHNICAL DATA PART-A and ANNEXURE FOR PERFORMANCE GUARANTEE AND TESTING.
44	Physical and/or CFD Sump Model Study to be conducted for Pumps with applicability as mentioned in TECHNICAL DATA PART-A. Dimensions of pump chamber/ sump in the Pump house shall be fixed up initially by BHEL based on Hydraulic Institute Standard (with Preliminary Layout attached with Specification). 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. 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.
45	**Instructions for Mandatory Spare:**
45.1	One(1) set consists of quantity required for complete replacement for one(1) Pump of each type/size.Also the 'set' would include all components/hardware required to replace the item.
45.2	Wherever quantity has been specified as percentage (%), it shall mean percentage (%) of the total population of the item in the station (project), unless specified otherwise and the fraction will be rounded off to the next higher whole number.
45.3	Wherever the quantities have been indicated for each type, size, thickness, material, radius, range etc. these shall cover all the items supplied and installed and the break up for these shall be furnished in the bid.
45.4	In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities in line with the approach followed as above.

45.5	Each spare shall be clearly marked and labeled on the outside of the packing with its description. When more than one spare part is packed in single case, a general description of the contents shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification.
46	The reputed makes of various bought out items of bidder (i.e. motor, bearings, mechanical seal etc.) shall be subject to BHEL/Customer approval in the event of order.
47	Instrument air/ service air is not envisaged by BHEL/customer for this package, vendor to design equipment/instrument accordingly without requirement of instrument air/ service air.
C&I TECHNICAL REQUIREMENT	
1	Lubricating water system shall be controlled through DDCMIS (BHEL scope).
2	Complete field instrumentation for monitoring and operation of Lubricating water system shall be provided by Vendor.
3	The quantity of instruments for the system shall be as per tender P &ID provided of the respective system as a minimum, for bidding purpose.
4	Root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifold, junction boxes and all other accessories required for erection of local / remote instruments shall be provided by Vendor. Double root valve to be provided where the design pressure is or more than 40kg/cm2.
5	The contacts of equipment mounted instruments, sensors, switches etc. for external connection including spare contacts shall be wired out in flexible/rigid conduits, independently to suitably located common junction boxes.
6	Bidder to provide RTD for Pump Bearing & winding Temperature Measurement for HT driven pumps.
7	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.
8	The Profibus protocol design shall be further validated by BHEL and approved by NTPC during detailed engineering and any variation/changes required based on DDCMIS system requirements and actual field installation,operational philosophy etc. shall be considered by bidder without any implications.
9	For all profibus devices GSD/DD and DTM files are to be provided for configuration/ testing in the DDCMIS for proper interfacing and diagnostics.
10	Reverse Rotation Indicator shall be in Bidder's scope of supply.
11	Reverse rotation indicator comprising of proximity sensors, processing electronics with output of 4-20mA (corresponding to speed) interconnecting cables, speed display in rpm, normal, reverse indication and required channel alarm contact shall be provided. The contact rating shall be 60VDC, 6VA (or more if required by Control system). The exact details of the RRI shall be strictly as approved by Employer during detailed engineering. The power supply of RRI is to be arranged by the Bidder.

12	All instruments other than profibus type shall be terminated on JB in field. Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 12-15 mtrs) and trunk cable. In case grouping is not possible and these are to be installed individually, canopy with suitable mounting arrangement shall be provided.
13	TYPE TEST GENERAL REQUIREMENT
13.1	Submission of type test results and certificate shall be acceptable provided:
13.1.1	The same has been carried out by the Bidder/ sub-vendor on exactly the same model /rating of equipment.
13.1.2	There has been no change in the components from the offered equipment & tested equipment.
13.1.3	The test has been carried out as per the latest standards alongwith amendments as on the date of Bid opening.
13.2	In case the approved equipment is different from the one on which the type test had been conducted earlier or any of the above grounds, then the tests have to be repeated and the cost of such tests shall be borne by the Bidder/ sub-vendor within the quoted price and no extra cost will be payable by the Employer on this account.
13.3	The schedule of conduction of type tests/ submission of reports shall be submitted and finalized during pre-award discussion.
13.4	For the type tests to be conducted, Contractor shall submit detailed test procedure for approval by Employer. This shall clearly specify test setup, instruments to be used, procedure, acceptance norms (wherever applicable), recording of different parameters, interval of recording, precautions to be taken etc. for the tests to be carried out.

1.0 INTENT OF SPECIFIATION

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

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

2.0 CODES AND STANDARDS

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

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

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

3.0 DESIGN REQUIREMENTS

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

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

3.3 Starting Requirements

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

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

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

3.3.3 The following frequency of starts shall apply

i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.

ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour)

iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for mimimum 20,000 starts during the life time of the motor

3.4 **Running Requirements**

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

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

3.5 **Stress During bus Transfer**

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

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

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

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

4.0 **CONSTRUCTIONAL FEATURES**

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

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

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

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

4.4. Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.

4.5 Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.

4.6 In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation.
In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.

4.7 **Terminals and Terminal Boxes**

4.7.1 Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A.

Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".

4.7.2 unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.

4.7.3 Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W & V respectively.

4.7.4 Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.

4.7.5 Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.

4.7.6 Degree of protection for terminal boxes shall be IP 55 as per IS 4691.

4.7.7 Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.

4.7.8. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.

4.7.9 Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.

4.8 Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.

4.9 **General**

4.9.1 Motors provided for similar drives shall be interchangeable.

4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.

4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.

4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.

4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.

4.9.6 Name plate with all particulars as per IS: 325 shall be provided

4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.

5.0 INSPECTION AND TESTING

5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.

5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.

5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.

5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.

6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT

a) OGA drawing showing the position of terminal boxes, earthing connections etc.
b) Arrangement drawing of terminal boxes.
c) Characteristic curves:
(*To be given for motor above 55 kW unless otherwise specified in Data Sheet*).

i) Current vs. time at rated voltage and minimum starting voltage.
ii) Speed vs. time at rated voltage and minimum starting voltage.
iii) Torque vs. speed at rated voltage and minimum voltage.
For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.
iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.

TECHNICAL SPECIFICATION OF CABLE GLANDS AND LUGS

Cable glands shall conform to BS:6121. Cable glands shall be made of heavy-duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 microns. All washers and Hardware shall also be made of brass with nickel chrome plating. Rubber components shall be of neoprene or better synthetic material and of tested quality.

Cable lugs/ferrules shall be solderless crimping type suitable for power and control cables as per the DIN 46239. Aluminum solderless crimping lugs/ ferrules shall be used for Aluminum cables and Copper lugs/ferrules shall be used for Copper cables. Bimetallic washers or bimetallic type lugs shall be used for bimetallic connections

ANNEXURE VIII

TENTATIVE LIST OF CABLE SIZES

1.1 kV, XLPE INSULATED POWER CABLES		**1.1 kV, CONTROL CABLES**	**225V, SCREENED CONTROL CABLES**	
ARMOURED, AL CONDUCTOR	**ARMOURED, CU CONDUCTOR**	**COPPER CONDUCTOR PVC INSULATED ARMOURED CONTROL CABLES**	**TYPE 'F' CABLES, ARMOURED (IO)**	**TYPE 'G' CABLES, ARMOURED (O)**
1C-150	2C-2.5	2C-1.5	2P - 0.5	2P - 0.5
1C-300	3C-2.5	3C-1.5	4P - 0.5	4P - 0.5
1C-630	4C-2.5	5C-1.5	8P - 0.5	8P - 0.5
2C-10		7C-1.5	12P - 0.5	12P - 0.5
2C-25		12C-1.5		16P - 0.5
2C-95		14C-1.5		20P - 0.5
3C-10		19C-1.5		
3C-16		5C-2.5		
3C-25		10C-2.5		
3C-50		14C-2.5		
3C-95		19C-2.5		
3C-150				
3C-240				
3.5C-25				
3.5C-50				
3.5C-95				
3.5C-150				
3.5C-240				
4C-10				

	TECHNICAL SPECIFICATION MISC. PUMPS (VERTICAL) 2X800 MW LARA STAGE-II & 2X800 SINGRAULI STAGE-III	PE-TS-508/512-100-W002 Rev. No. 00 Date : 14.08.25

CHECKLIST FOR INSTALLATION CHECK OF THE VERTICAL PUMP AT SITE

Note:
- **To be filled in by BHEL Site Engineer and Pump Vendor Service Engineer**
- **Strike off which is not applicable**

Project Name / PO No.:	**Date of Check:**
Pump Name:	**Pump Serial No:**

S. No.	ACTIVITY DESCRIPTION	OBSERVATION	REMARKS (IF ANY)
1	Relevant Engineering data like General Arrangement Drawing & Cross Sectional Drawing is available with site engineer for reference	Yes/No	
2	All components are available as per packing list or Approved Documents	Yes/No	
3	Condition of Pump components	OK/Not OK	
4	Pump foundation dimensions as per GA drawing (List out deviations if any)	OK/Not OK	
5	Discharge piping as per GA drawing and pump is free from piping strains.	Yes/No	
6	Suction Sump Dimensions as per drawing and is free from any debris.	Yes/No	
7	Check Sole Plate leveling with spirit level	OK/Not OK	
8	Grouting of sole plate- Tightness of hardware to be checked	OK/Not OK	
9	Blue matching between sole plate & surface discharge head/ Motor Stand.	OK/Not OK %	
10	All hardwares are tight	Yes/No	
11	Is the pump shaft of bowl assembly free to rotate	Yes/No	
12	Axial play of pump shaft as per design (mm)	OK/Not OK	
13	Radial run out of line shafts (to be checked on rollers with the help of a dial gauge)As per IS:1710	OK/Not OK	
14	Check fitment of (a) Line shaft & Line shaft coupling (b) Key in respective Keyway (c) Packing box (d) Free movement of ratchet pin in its pocket	OK/Not OK OK/Not OK OK/Not OK OK/Not OK	
15	Tightness of bolts at each joint assembled during erection	OK/Not OK	
16	Oil level in Thrust stand assembly	Ok/Not OK	

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

ADDITIONAL REMARKS/OBSERVATION (IF ANY)

1.

2.

3.

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

	TECHNICAL SPECIFICATION MISC. PUMPS (VERTICAL) 2X800 MW LARA STAGE-II & 2X800 SINGRAULI STAGE-III		PE-TS-508/512-100-W002
			Rev. No. 00
			Date : 14.08.25

TECHNICAL DATA - PART - A (2X800 MW LARA)

SL.NO	DESCRIPTION	UOM	DETAIL	DETAIL
	Designation/Name of the Pump		RAW WATER (PT) PUMPS	RAW WATER (ASH) PUMPS
1.0	**Scope of Supply & Services**			
	The scope covers the design, manufacture, assembly, inspection and testing at manufacturer's and/or his sub-contractors works, proper packing for delivery and installation checks at site for Miscellaneous Pumps along with mandatory spares complete with all accessories as per the requirements specified in this specification, PG Test at site and any other services, etc. if called for in the succeeding sections of the specification.			
1.1	Scope of supply of Pump Accessories and Spares:			
1.1.1	LT Electric motor with cable glands and lugs at motor end.		No (HT Motor is free issue by BHEL)	Yes
1.1.2	Strainer at Pump Bowl Assembly Inlet		As per Bidder's Standard Design	As per Bidder's Standard Design
1.1.3	Pump motor coupling (Heavy duty) along with coupling guard		Yes	Yes
1.1.4	Common base/sole plate for pumps and motor		Yes	Yes
1.1.5	Thrust block assembly (Thrust pads, attachments) for transferring the pump thrust to concrete thrust block (concrete thrust block in purchaser scope)		No, 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.	No, 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.
1.1.6	Self contained lubrication system along with all internal piping, valves, fittings, specialties etc. as required		Yes	Yes
1.1.7	Counter flanges for suction/ discharge nozzles along with fixing nuts, bolts and gaskets		Yes	Yes
1.1.8	Anchor bolts, nuts, seating steel works, shims etc. as necessary for mounting the pump-motor unit on civil foundations		Yes	Yes
1.1.9	Vent Connection with piping, Air Relief valve on Pump Discharge Head		Yes	Yes
1.1.10	Drain connections in Casing and Base Plate with piping & isolating valves/plugs		Yes	Yes
1.1.11	Lifting/ handling attachments/lugs for the pump and motor		Yes	Yes

1.1.12	Any fixtures, clamps, etc. necessary raising/ lowering of the pump assembly piece by piece		Yes	Yes
1.1.13	First fill of lubricants with toping requirements for one year of operation after commissioning and handing over of equipment		Yes	Yes
1.1.14	Set of “Special” Tools & Tackles for Pumps and motors, if any		Yes	Yes
1.1.15	Erection and commissioning spares, “on as required” basis		Yes	Yes
1.1.16	RTD for Pump Thrust Bearing		Yes	No
1.1.17	1 No. Reverse Rotation Indicating Switch for each Pump		Yes	Yes
1.1.18	Ratchet for protection from Reverse Rotation		Yes	Yes
1.1.19	Mandatory Spares (Details as per BOQ Schedule)		Yes	Yes
1.1.20	Rubber Expansion Joint		No	Yes
1.2	Scope of Services at Site:			
1.2.1	Installation Check of Pumps at site prior to their commissioning		Yes	Yes
1.2.2	Performance Testing at Site		Yes	Yes
1.3	Physical Sump Model Study of Pump House		No	No
1.4	CFD Sump Model Study of Pump House		No	No
2.0	**DESIGN CODES & STANDARDS**			
2.1	Design Standard		IS-1710/IS-5120/IS-5659/HIS	
2.2	Performance Standard		IS-9137/IS-5120/HIS/ASME PTC 8.2	
2.3	Flange & Counter Flange		AWWA class - C-207	
2.4	Structural steel		IS 2062	
2.5	Cast Iron		IS 210	
2.6	Threaded Steel Fasteners		IS 1367	
2.7	Alloy-Steel and Stainless Steel Bolting		ASTM A193	
2.8	Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts		ASTM A194	
2.9	Carbon Steel Castings		ASTM A216	
2.10	Carbon Steel Forgings		ASTM A105	
2.11	Stainless Steel Castings		ASTM A351	
2.12	Stainless Steel Forgings		ASTM A276	
2.13	Duplex Stainless Steel Castings		ASTM A890 / ASTM A995	

2.14	Corrosion Resistance Alloy Steel Castings		ASTM A743	
3.0	**DESIGN /SYSTEM PARAMETERS**			
3.1	KKS Number (TAG NO.)/Description		-	-
3.2	Total No. of pumps (Nos.)		3	3
3.3	No. of working & standby pumps		2 Working + 1 Standby	2 Working + 1 Standby
3.4	Location		Outdoor	Outdoor
3.5	Pump suitable for parallel operation		Yes	Yes
3.6	Pump Duty		Continuous	Continuous
3.7	Rated capacity (No negative tolerance permitted)	cu.m/hr	2400	275
3.8	Total Dynamic Head (TDH) at rated capacity (At Bowl, excluding Pumps Internal frictional losses upto discharge) (No negative tolerance permitted)	MWC	42	60
3.9	Max. limit on shut off head Corresponding to pump TDH at 51.5 Hz	MWC	115-130% of the rated head	
3.10	Required Range of Operation of the Pump (% of Rated Capacity)		40% to 120% of the rated flow	
3.11	The pumps offered have continuously rising head capacity curves from the duty point towards shut off point.		Yes	
3.12	The pumps offered have stable rising H-Q curves within the "Range of Operation"		Yes	
3.13	Pump characteristics		Non Overloading type & stable	
3.14	Maximum permissible speed of pump	RPM	1500	
3.15	Floor Level - for Pump Mounting	M	RL 207.5 M	
3.16	Minimum Water Level	M	RL 195.0 M	
3.17	Maximum Water Level	M	RL 206.5 M	
3.18	Sump Invert Level	M	RL 192.5 M	
3.19	Crane Hook Level	M	RL 212.5 M	
3.20	Crane Capacity Available	Ton	10 Ton	
3.21	Max. Handling Weight Limit	Ton	8 Ton	
3.22	System Design Pressure	kg/cm2 (g)	10	
3.23	Design Temperature	Deg. C	60	
3.24	Specific Gravity of fluid to be handled		1	
3.25	Quality of Water Handled		Raw water	

4.0	**CONSTRUCTION FEATURES**			
4.1	Type of Pump to be offered		Vertical Turbine, Mixed Flow Type	
4.2	Type of Impeller to be offered		Closed/Semi Closed	
4.3	Pump Discharge		Above Floor	
4.4	Cooling/Lubrication Arrangement to be provided for Mechanical Seal/Gland		By Forced Water Lubrication	
4.5	Cooling/Lubrication Arrangement to be provided for Thrust Bearing		By Oil & Forced Water Lubrication	
4.6	Cooling/Lubrication Arrangement to be provided for Line Shaft Bearing		By Forced Water Lubrication	
4.7	Shaft Sealing Arrangement		Gland Packing	
4.8	Pump Discharge Connecting Pipe Size (OD x Thk)	mm x mm	610.0X6.0	219.1X6.0
4.9	Minimum Column Pipe Thickness	mm	10	10
4.10	Motor rating selection criteria		Continuous motor rating (at 50 deg C ambient) for all pumps shall be at least ten per cent (10%) above the maximum load demand of the driven equipment in the complete operating range (including run out condition) to take care of the system frequency/voltage variation	
4.11	Type of coupling between pump & motor		Flexible Type	Flexible Type
4.12	**Material of Construction**			
4.12.1	Casing & Suction Bell		2.5% Ni CI to IS 210 GR FG-260 (S-0.1% max and P-0.15% max) with ss casing liner	
4.12.2	Column Pipe & Discharge Head		Fabricated steel as per IS: 2062 with 2 coats of epoxy coating inside & outside	
4.12.3	Impeller		Austenitic SS ASTM A743 CF8M Grade	
4.12.4	Shaft / Line Shaft		SS 410	
4.12.5	Shaft sleeves		SS 410	
4.12.6	Shaft Coupling		SS 410	
4.12.7	Wear ring		SS 316	
4.12.8	Fasteners (Wetted)		SS-316	
4.12.9	Fasteners (Non-Wetted)		MS-High Tensile Steel	
4.12.10	Pump/Motor Coupling		CI	

4.12.11	Intermediate stage bearings		Cutless rubber with bronze retainer for below minimum water level and Thordon type for above minimum water level.	
4.12.12	Gland Plate & Stuffing Box		2.5% Ni CI to IS 210 GR FG-260	
4.12.13	Lantern ring		As per Manufacturer standard	
4.12.14	Mechanical seals (faces)		NA	
4.12.15	Gland packing		Teflon Impregnated (Non-Asbestos type)	
4.12.16	Base/ Sole Plate		MS Fabricated IS-2062 (min. thk.-12 mm) Epoxy Coated	
4.12.17	Thrust pad (if applicable)		Carbon Steel with White Metal Lining	
4.12.18	Counter Flange		Carbon Steel	
4.12.19	Gaskets		Wire reinforced rubber gasket / Neoprene Rubber / Compressed Asbestos Fibre	
4.12.20	Shaft Enclosing tube		Fabricated steel as per IS: 2062 (Min. Thickness - 6 mm) with 2 coats of epoxy coating inside & outside	
4.12.21	Bearing cooling system pipes and valves		SS	
4.12.22	Strainer Housing/Body		CS as per IS :2062	
4.12.23	Strainer Mesh		SS 316	
4.12.24	Connecting pipe material (for deciding counterflange material)		Caron steel (IS 2062, Gr B), Rolled & weded confirming to IS 3589	
4.13	Design Life of Bearing	Hrs	20000 Hrs	
4.14	Sealing of Stuffing Box		By Gland Packing	
4.15	Type of Mechanical Seal (If applicable)		Cartridge Type	
4.16	The bidder shall make provisions for mounting following on the pump/ pump shaft: a. Purchaser's probes in bearings of pumps b. Flat surface with dimensions 60 MM x60 MM on bearing Housing for mounting vibration measuring block c. Key slots of dimensions 30MM (L) X 15 MM (W) X 3 MM (D) on each pump shaft or some other suitable location		Yes	Not Applicable

4.17	Complete Forced Water Lubrication System including Pump, Strainer, Piping, Valves & Instrumentation (Minimum)		As per attached P&ID of Plant Water System	
4.18	Configuration & Type of Strainer in Forced Water Lubrication System		2X100% Manual Basket Strainers	
5.0	**PERFORMANCE PARAMETERS**			
5.1	Performance Guarantee Tests at Shop/Works		Yes, To be performed by Manufacturer	Yes, To be performed by Manufacturer
5.2	Performance Guarantee Tests at Site		Yes, To be performed by Manufacturer	Yes, To be performed by Manufacturer
5.3	Benchmark Pump efficiency (P) for Bid evaluation	%	85	76
5.4	Benchmark Motor efficiency(M) for Bid evaluation	%	95	95
5.5	Bid Evaluation Rate (The bid evaluation shall be done at the rate as specified in Data Sheet A per one (1) KW Power consumption, per working pump (and not standby)).	Rs./kW	4 lacs	4 lacs
5.6	Guaranteed vibration at manufacturer's works on any pump /motor bearing w.r.t. velocity (Vrms) as per ANSI/ HIS 9.6.4	Vrms	5.3	4.3
5.7	Guaranteed vibration at site on any pump /motor bearing w.r.t. velocity (Vrms) as per ANSI/ HIS 9.6.4	Vrms	4.3	3.3
5.8	Max. noise Level (Guaranteed at site)	dB	85 dB at 1 M distance	85 dB at 1 M distance

TECHNICAL DATA - PART - A (2X800 MW SINGRAULI)

SL.NO	DESCRIPTION	UOM	DETAIL
	Designation/Name of the Pump		AUX. CT PUMPS
1.0	**Scope of Supply & Services**		
	The scope covers the design, manufacture, assembly, inspection and testing at manufacturer's and/or his sub-contractors works, proper packing for delivery and installation checks at site for Miscellaneous Pumps along with mandatory spares complete with all accessories as per the requirements specified in this specification, PG Test at site and any other services, etc. if called for in the succeeding sections of the specification.		
1.1	**Scope of supply of Pump Accessories and Spares:**		
1.1.1	LT Electric motor with cable glands and lugs at motor end.		No (Motor with VFD is free issue by BHEL)
1.1.2	Strainer at Pump Bowl Assembly Inlet		As per Bidder's Standard Design
1.1.3	Pump motor coupling (Heavy duty)		Yes
1.1.4	Common base/sole plate for pumps and motor		Yes
1.1.5	Thrust block assembly (Thrust pads, attachments) for transferring the pump thrust to concrete thrust block (concrete thrust block in purchaser scope)		No, 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.
1.1.6	Lubrication system along with all internal piping, valves, fittings, specialties etc. as required & described in Specification		Yes
1.1.7	Counter flanges for suction/ discharge nozzles along with fixing nuts, bolts and gaskets		Yes
1.1.8	Anchor bolts, nuts, seating steel works, shims etc. as necessary for mounting the pump-motor unit on civil foundations		Yes
1.1.9	Vent Connection with piping, Air Relief valve on Pump Discharge Head		Yes
1.1.10	Gland Drain connections in Casing/Base Plate with piping & isolating valves/plugs as required		Yes
1.1.11	Lifting/ handling attachments/lugs for the pump and motor		Yes
1.1.12	Any fixtures, clamps, etc. necessary raising/ lowering of the pump assembly piece by piece		Yes
1.1.13	First fill of lubricants with toping requirements for one year of operation after commissioning and handing over of equipment		Yes
1.1.14	Set of "Special" Tools & Tackles for Pumps and motors, if any		Yes

1.1.15	Erection and commissioning spares, “on as required” basis		Yes
1.1.16	RTD for Pump Thrust Bearing		Yes
1.1.17	1 No. Reverse Rotation Indicating Switch for each Pump		Yes
1.1.18	Ratchet for protection from Reverse Rotation		Yes
1.1.19	Mandatory Spares (Details as per BOQ Schedule)		Yes
1.1.20	Rubber Expansion Joint		No
1.2	**Scope of Services at Site:**		
1.2.1	Installation Check of Pumps at site prior to their commissioning		Yes
1.2.2	Performance Testing at Site		Yes
1.3	Physical Sump Model Study of Pump House		No
1.4	CFD Sump Model Study of Pump House		No
2.0	**DESIGN CODES & STANDARDS**		
2.1	Design Standard		IS-1710/IS-5120/IS-5659/HIS
2.2	Performance Standard		IS-9137/IS-5120/HIS/ASME PTC 8.2
2.3	Flange & Counter Flange		AWWA class - C-207 / ANSI B16.1
2.4	Structural steel		IS 2062
2.5	Cast Iron		IS 210
2.6	Threaded Steel Fasteners		IS 1367
2.7	Alloy-Steel and Stainless Steel Bolting		ASTM A193
2.8	Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts		ASTM A194
2.9	Carbon Steel Castings		ASTM A216
2.10	Carbon Steel Forgings		ASTM A105
2.11	Stainless Steel Castings		ASTM A351
2.12	Stainless Steel Forgings		ASTM A276
2.13	Duplex Stainless Steel Castings		ASTM A890 / ASTM A995
2.14	Corrosion Resistance Alloy Steel Castings		ASTM A743
3.0	**DESIGN /SYSTEM PARAMETERS**		
3.1	KKS Number (TAG NO.)/Description		GAA01AP001/GAA01AP002/GAA01AP003GAA01AP004
3.2	Total No. of pumps (Nos.)		4
3.3	No. of working & standby pumps		3 Working + 1 Standby
3.4	Location		Outdoor
3.5	Pump suitable for parallel operation		Yes

3.6	Pump Duty		Continuous
3.7	Rated capacity (No negative tolerance permitted)	cu.m/hr	2330
3.8	Total Dynamic Head (TDH) at rated capacity (At Bowl, excluding Pumps Internal frictional losses upto discharge) (No negative tolerance permitted)	MWC	25
3.9	Max. limit on shut off head Corresponding to pump TDH at 51.5 Hz	MWC	approximately 50% more than the design head
3.10	Required Range of Operation of the Pump (% of Rated Capacity)		40% to 120% of the rated flow
3.11	The pumps offered have continuously rising head capacity curves from the duty point towards shut off point.		Yes
3.12	The pumps offered have stable rising H-Q curves within the "Range of Operation"		Yes
3.13	Pump characteristics		Non Overloading type & stable
3.14	Maximum permissible speed of pump	RPM	1500
3.15	Floor Level - for Pump Mounting	M	RL 275.85 M
3.16	Minimum Water Level	M	RL 270.8 M
3.17	Maximum Water Level	M	RL 274.25 M
3.18	Sump Invert Level	M	RL 267.5 M
3.19	Crane Hook Level	M	RL 281.35 M
3.20	Crane Capacity Available	Ton	10 Ton
3.21	Max. Handling Weight Limit	Ton	8 Ton
3.22	System Design Pressure	kg/cm2 (g)	5
3.23	Design Temperature	Deg. C	60
3.24	Specific Gravity of fluid to be handled		1
3.25	Quality of Water Handled		Raw water (at operating temp of 33 to 47 deg C)
4.0	**CONSTRUCTION FEATURES**		
4.1	Type of Pump to be offered		Vertical Turbine, Mixed Flow Type. **Pump should be capable to run with VFD coupled Motor at variable speeds. Pump Manufacturer to provide Pump Characteristic curve at variable operating speeds.**
4.2	Type of Impeller to be offered		Closed/Semi Open
4.3	Pump Discharge		Above Floor
4.4	Cooling/Lubrication Arrangement to be provided for Mechanical Seal/Gland		By Forced Water Lubrication

4.5	Cooling/Lubrication Arrangement to be provided for Thrust Bearing		By Oil & Forced Water Lubrication
4.6	Cooling/Lubrication Arrangement to be provided for Line Shaft Bearing		By Forced Water Lubrication
4.7	Shaft Sealing Arrangement		Gland Packing
4.8	Pump Discharge Connecting Pipe Size (OD x Thk)	mm x mm	610.0X6.0
4.9	Minimum Column Pipe Thickness	mm	10
4.10	Motor rating selection criteria		Continuous motor rating (at 50 deg C ambient) for all pumps shall be at least ten per cent (10%) above the maximum load demand of the driven equipment in the complete operating range (including run out condition) to take care of the system frequency/voltage variation
4.11	Type of coupling between pump & motor		Flexible Type
4.12	**Material of Construction**		
4.12.1	Casing & Suction Bell		2.5% Ni CI to IS 210 GR FG-260 (S-0.1% max and P-0.15% max) with ss casing liner
4.12.2	Column Pipe & Discharge Head		Fabricated steel as per IS: 2062 (Min. Thickness - 10 mm) with 2 coats of epoxy coating inside & outside
4.12.3	Impeller		Austenitic SS ASTM A743 CF8M Grade
4.12.4	Shaft / Line Shaft		SS - ASTM A 276 Gr. 410
4.12.5	Shaft sleeves		SS 410 (Hardened)
4.12.6	Shaft Coupling		SS - ASTM A 276 Gr. 410
4.12.7	Wear ring		SS 316
4.12.8	Fasteners (Wetted)		SS-316
4.12.9	Fasteners (Non-Wetted)		MS-High Tensile Steel
4.12.10	Pump/Motor Coupling		SS - ASTM A 276 Gr. 410
4.12.11	Shaft bearings		Cutless rubber with bronze retainer for below minimum water level and Thordon type for above minimum water level.
4.12.12	Gland Plate & Stuffing Box		2.5% Ni CI to IS 210 GR FG-260
4.12.13	Lantern ring		SS 316
4.12.14	Mechanical seals (faces)		NA
4.12.15	Gland packing		Teflon Impregnated (Non-Asbestos type)
4.12.16	Base/ Sole Plate		MS Fabricated IS-2062 (min. thk.-12 mm) Epoxy Coated
4.12.17	Thrust pad (if applicable)		Carbon Steel with White Metal Lining
4.12.18	Counter Flange		Carbon Steel

4.12.19	Gaskets		Wire reinforced rubber gasket / Neoprene Rubber / Compressed Asbestos Fibre
4.12.20	Shaft Enclosing tube		Fabricated steel as per IS: 2062 (Min. Thickness - 6 mm) with 2 coats of epoxy coating inside & outside
4.12.21	Bearing cooling system pipes and valves		SS
4.12.22	Strainer Housing/Body		CS as per IS :2062
4.12.23	Strainer Mesh		SS 316
4.12.24	Connecting pipe material (for deciding counterflange material)		Caron steel (IS 2062, Gr B), Rolled & weded confirming to IS 3589
4.13	Design Life of Bearing	Hrs	20000 Hrs
4.14	Sealing of Stuffing Box		By Gland Packing
4.15	The bidder shall make provisions for mounting following on the pump/ pump shaft: a. Purchaser's probes in bearings of pumps b. Flat surface with dimensions 60 MM x60 MM on bearing Housing for mounting vibration measuring block c. Key slots of dimensions 30MM (L) X 15 MM (W) X 3 MM (D) on each pump shaft or some other suitable location		Yes
4.16	Complete Forced Water Lubrication System including Pump, Strainer, Piping, Valves & Instrumentation (Minimum)		As per attached P&ID of Plant Water System
4.17	Configuration & Type of Strainer in Forced Water Lubrication System		2X100% Manual Basket Strainers
5.0	**PERFORMANCE PARAMETERS**		
5.1	Performance Guarantee Tests at Shop/Works		Yes, To be performed by Manufacturer
5.2	Performance Guarantee Tests at Site		Yes, To be performed by Manufacturer
5.3	Benchmark Pump efficiency (P) for Bid evaluation	%	86
5.4	Benchmark Motor efficiency(M) for Bid evaluation	%	95
5.5	Bid Evaluation Rate (The bid evaluation shall be done at the rate as specified in Data Sheet A per one (1) KW Power consumption, per working pump (and not standby)).	Rs./kW	Rs. 3.6 Lacs
5.6	Guaranteed vibration at manufacturer's works on any pump /motor bearing w.r.t. velocity (Vrms) as per ANSI/ HIS 9.6.4	Vrms	5.3

5.7	Guaranteed vibration at site on any pump /motor bearing w.r.t. velocity (Vrms) as per ANSI/ HIS 9.6.4	Vrms	4.3
5.8	Max. noise Level (Guaranteed at site)	dB	85 dB at 1 M distance

Annexure-2

VERTICAL PUMPS

1.00.00 SCOPE

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

2.00.00 CODES AND STANDARDS

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

2.02.00 **List of Applicable Standards**

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

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

HIS : Hydraulic Institute Standards U.S.A.

PTC 82 : Centrifugal pumps-power test code

API 610: Centrifugal pumps for general refinery purposes.

3.00.00 DESIGN AND PERFORMANCE REQUIREMENTS

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

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

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

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

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

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

3.07.00 Pump shall run smoothly without undue noise and vibration. The vibration limit measured at motor end shall not exceed the limit specified in Hydraulic Institute Standards. The noise level shall not exceed 85 dBA overall sound pressure level reference 0.0002 microbar (the standard pressure reference for air sound measurement) at a distance of 1M from the equipment surface.

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

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

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

3.10.00 Reverse Rotation

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

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

3.11.00 Motor Rating

The pumps shall be capable of starting with discharge valve fully closed as well as fully open conditions. Motors shall be selected to suit to the above requirements. Continuous motor rating (at 50^{0}C ambient) for all pumps shall be at least ten per cent (10%) above the maximum load demand of the driven equipment in the complete operating range (including run out condition) to take care of the system frequency/voltage variation.

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

4.00.00 DESIGN AND CONSTRUCTION

4.01.00 **Pump Type**

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

4.02.00 **Discharge head**

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

4.03.00 **Column Pipe**

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

4.04.00 **Impeller**

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

4.05.00 **Wearing Rings**

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

4.06.00 **Impeller & Line Shaft**

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

4.07.00 **Pump & Shaft Bearings - lubrication**

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

4.07.02 **Self water Lubrication System**

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

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

4.07.03 **Forced water lubrication system**

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

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

4.08.00 **Thrust Bearings**

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

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

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

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

4.10.00 **Stuffing Box**

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

4.11.00 **Assembly and Dismantling**

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

5.00.00 **Technical Data Sheet (if not mentioned specifically elsewhere in the CW System technical specifications) of Pumps**

SN	Description	Parameters
1	Designation	As applicable
2	Total No. of Pumps	As applicable
3	No. of Working Pumps	As applicable
4	No. of Standby Pumps	
5	Guaranteed Flow & Total Head (Guaranteed)	
6	Operating Speed (Max.)	1500 rpm
7	Pumps and drives to be designed for	Outdoor duty & Continuous Operation
10	Type of Pump	Vertical Wet Pit & Non-Pull out type

13	Type of Discharge	Above Floor
14	Type of Impeller	Closed / Semi-open
16	Type of Lubrication	Forced water/ Self lubrication (as specified)
18	Minimum Water Level in sump	Min submergence level of pump plus 0.5.m
19	Maximum Water Level in sump	As per system requirement (Min 0.2 m below FGL)
21	Sump Invert Level	As per HIS
22	Operating Floor Level	Min. 0.5 M above FGL
23	Other dimensions of sump, Fore-bay etc	As per HIS & system requirement
26	**MOC**	
i	Suction Bell, Casing / Bowl	2.5% Nickel Cast Iron, IS: 210 Grade FG 260; S-0.1% max. P-0.15% max.
ii	Casing Liner	Stainless steel (SS)
iii	Impeller	Austenitic SS ASTM A743/ CF8M Grade
iv	Wearing rings	SS-316
v	Impeller Shaft, Pump & line shaft, Pump & Shaft Coupling, Pump & Shaft Sleeves	SS - ASTM A 276 Gr. 410.
vi	Shaft bearings	Cutless rubber with bronze retainer for below minimum water level and Thordon type for above minimum water level.

vii	Column pipe	Fabricated steel as per IS: 2062 (minimum thickness - 10 mm) with 2 coats of epoxy coating inside & outside.
viii	Shaft Enclosing Tubes	Fabricated steel as per IS: 2062 (minimum thickness - 6 mm) with 2 coats of epoxy coating inside & outside.
ix	Discharge Head	Fabricated steel as per IS: 2062 (minimum thickness - 10 mm) with 2 coats of epoxy coating inside & outside.
x	Distance Piece (if applicable)	Fabricated steel as per IS: 2062 (min thickness 10 mm) with 2 coats of epoxy coating inside.
xii	Stuffing Box, Gland	2.5 % NI-CI to IS-210 FG-260
xiii	Gland Packing	Impregnated Teflon
xiv	Gaskets	Wire reinforced rubber gasket / Neoprene Rubber / Compressed Asbestos Fibre
xv	Ladders, Platforms & Other Accessories	Fabricated steel as per IS: 2062
xvi	Bolts & Nuts	Stainless Still AISI Type 316 for those coming in contact with water and for others material shall be High Tension Carbon Steel
xvii	Baseplate & Soleplate (min 12 mm thick), Matching flange	Fabricated steel as per IS: 2062

		on ground level)	
	e)	Outside stair case (spiral)	required
	f)	Inside Ladder	Required
	g)	Draw off sump	required
	h)	Root valve for level Transmitter	Root valves for two (2) nos. level transmitter for each tank Required

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2.18.00 **RUBBER EXPANSION JOINTS**

2.18.01 All parts of expansion joints shall be suitably designed for all stresses that may occur during continuous operation and for any additional stresses that may occur during installation and also during transient condition.

2.18.02 The expansion joints shall be single bellow rubber expansion joints. The arches of the expansion joints shall be filled with soft rubber.

2.18.03 The tube (i.e. inner cover) and the cover (outer) shall be made of natural or synthetic rubber of adequate hardness. The shore hardness shall not be less than 60 deg. A for outer and 50 deg. A for inner cover.

2.18.04 The carcass between the tube and the cover shall be made of high quality cotton duck, preferably, square woven to provide equal strength in both directions of the weave. The fabric plies shall be impregnated with age resistant rubber or synthetic compound and laminated into a unit.

2.18.05 Reinforcement, consisting of solid metal rings embedded in carcass shall be provided.

2.18.06 Expansion joints shall be complete with stretcher bolt assembly. The expansion joints shall be suitable to absorb piping movements and accommodate mismatch between pipe lines.

2.18.07 The expansion joints shall be of heavy duty construction made of high grade abrasion-resistant natural or synthetic rubber compound. The basic fabric for the' duck' shall be either a superior quality braided cotton or synthetic fiber having maximum flexibility and non-set characteristic.

2.18.08 The expansion joints shall be adequately reinforced, with solid steel rings, to meet the service conditions under which they are to operate.

2.18.09 All expansion joints shall be provided with stainless steel retaining rings for DM water application and IS 2062 Gr E-250B galvanized steel retaining rings for ordinary water for use on the inner face of the rubber flanges, to prevent any possibility of damage to the rubber when the bolts are tightened. These rings shall be split and beveled type for easy installation and replacement and shall be drilled to match the drilling on the end rubber flanges and shall be in two or more pieces.

2.18.10 The expansion joints shall have integral fabric reinforced full-face rubber flanges. The bolt on one flange shall have no eccentricity in relation to the corresponding bolt hole on the flange on the other face. The end rubber flanges shall be drilled to suit the companion pipe flanges. The flanges shall be as per ANSI B 16.5. For higher sizes, not covered under ANSI B 16.5, the same shall be as per AWWA.

CLAUSE NO.	TECHNICAL REQUIREMENTS

2.18.11 All exposed surfaces of the expansion joint shall be given a 3 mm thick coating of neoprene. This surface shall be reasonably uniform and free from any blisters, porosity and other surface defects.

2.18.12 Each control unit shall consist of two (2) numbers of triangular stretcher bolt plates, a stretcher bolt with washers, nuts, and lock nuts. Each plate shall be drilled with three holes, two for fixing the plate on to the companion steel flange and the third for fixing the stretcher bolt.

2.18.13 Each joint shall have a permanently attached brass or stainless-steel metal tag indicating the tag numbers and other salient design features.

2.18.14 Bidder to note that any metallic part which comes in contact with DM /corrosive water shall be of Stainless-Steel material.

2.18.15 **Life cycle test for RE Joints of Condenser CW Inlet Outlet lines:**

Life cycle test certificates shall be furnished by the bidder for each type and size of RE joints supplied by the Bidder, in the absence of which actual Life cycle test shall be conducted on one rubber expansion joint of each type and size.

2.19.00 **STRAINERS**

2.19.01 **Simplex type**

The strainers shall be basket type and of simplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipelines. The strainer element shall be 20 mesh. Pressure drop across the strainers in new condition shall not exceed 1.5 MCW at full flow. Wire mesh of the strainers shall be suitably reinforced, to avoid buckling under operation. Strainer shall have screwed blow off connection fitted with a removable plug. The material of construction of various parts shall be as follows:

(a)	Body	IS: 318, Gr. 2 up to 50 mm Nb, and IS: 210 Gr. FG 260 above 50 mm Nb. (For DM water/ -Body: AISI 316 or equivalent)
(b)	Strainer Element	Stainless steel (AISI 316)
(c)	End connection	Screwed up to 50 mm Nb, and Flanged above 50 mm Nb

2.19.02 **Duplex type**

(a) The strainers shall be basket type and of duplex construction. The strainer shall be provided with plugged drain/blow off and vent connections. The free area of the strainer element shall be at least four (4) times the internal area of the connecting pipe. The mesh of strainer element shall be commensurate with the actual service required. Pressure drop across the strainer in new condition shall not exceed 4.0 MWC at full flow.

(b) Wire mesh (if applicable) of the strainers shall be suitably reinforced. The material of construction of various parts shall be as follows.

Body	IS: 318, Gr. 2 up to 50 mm Nb, and IS:210,

BHEL	TECHNICAL SPECIFICATION MISC. PUMPS (VERTICAL) 2X800 MW LARA STAGE-II & 2X800 SINGRAULI STAGE-III	PE-TS-508/512-100-W002 Rev. No. 00 Date : 14.08.25

TECHNICAL DATA - PART - A

SL.NO	DESCRIPTION	UOM	DETAIL
1.0	**DESIGN CODES & STANDARDS**		
1.1	Three phase induction motors :		IS15999, IEC:60034, IS: 12615, IS: 325
1.2	Single phase AC motors		IS:996, IEC:60034
1.3	Energy Efficient motors		IS 12615, IEC:60034-30
1.4	Crane duty motors		IS:3177, IS/IEC:60034
1.5	Mechanical Vibration of Rotating Electrical Machines with Shaft Heights 56 mm and Higher - Measurement, Evaluation and Limits of Vibration Severity		IS 12075/IEC 60034-14
1.6	Designation of Methods of Cooling of Rotating Electrical Machines		IS 6362
1.7	Designation for types of construction and mounting arrangement of rotating electrical machines		IS 2253
2.0	**DESIGN /SYSTEM PARAMETERS**		
2.1	Rated voltage	V	415
2.2	Frequency	Hz	50
2.3	Permissible variations for		
a)	Voltage	%	+/-10
b)	Frequency	%	(+)3 to (-)5
c)	Combined	%	10 (absolute sum)
2.40	System fault level at rated voltage for 1 sec	kA	50
2.4	Short time rating for terminal boxes for 0.25 sec	kA	50
2.5	Type of motors		a)Squirrel cage induction motor suitable for direct-on-line starting (for non- VFD motors). b)Motor operating through VFD (if applicable) shall be suitable for inverter duty with VPI insulation.
2.6	Efficiency class		*IE3*
2.8	Rating		
a)	Motor duty		Continously rated-S1
b)	Design margin over continous max. demand of the driven equipment (min)		10%
3.0	**CONSTRUCTION FEATURES**		

3.1	Winding		Electrolytic grade Copper conductor
3.2	Enclosure Details		
a)	Degree of protection		
	i) Indoor motors		*IP55*
	ii) Outdoor motors		IP 55 with detachable metal canopy
b)	Method of ventilation		Totally enclosed fan cooled (TEFC)
3.3	Insulation		Class 'F' with temperature rise limited to class 'B'. Non-hygroscopic, oil resistant, flame resistant Insulation.
3.4	Bearings		Grease lubricated ball or roller bearings for Horizontal motors Grease lubricated ball or roller bearings or combined thrust and guide beaing for Vertical motors.
3.5	Main terminal box		
a)	Type		-Motor terminal box shall be detachable type and located in accordance with Indian Standards clearing the motor base- plate/ foundation. -Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame. - The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.
b)	DOP		Same as motor
c)	Position when veiwed from the non driving end		Left hand side
d)	Rotation		90 Deg.
e)	Space heater		Motors rated 30KW and above shall have space heater suitable for 240V, 50 Hz single phase AC supply.
f)	Cable glands and lugs		-Motor terminal box shall be furnished with Solder less crimping type heavy duty Lugs (aluminium lugs for aluminium cables and copper lugs for copper cables) and double compression Ni-Cr plated brass glands to match with cable used.

3.6	Earthing points suitable for conenction		Motor body shall be grounded at two earthing points on opposite sides with two separate and distinct grounding pads complete with tapped holes, GI bolts and washers.
3.7	Paint shade (Corrosion proof paints of colour shade)		RAL 7032/
3.8	The spacing between gland plate & centre of bottom terminal stud		Above 7 KW - upto 13 KW 115 Above 13 KW - upto 24 KW 167 Above 90 KW - upto 125 KW 331 Above 125 KW-upto 200 KW 385/203 (For Single core cables only)
3.9	Minimum inter-phase and phase-earth air clearances with lugs installed		UP to 110 KW 10mm Above 110 KW and upto 150 KW 12.5mm Above 150 KW 19mm
3.10	Local push Button Station		The local push button stations shall be dust and vermin roof and shall have a degree of protection of IP - 55. Push buttons shall be of heavy duty spring return, push-to-actuate type. Their contacts shall be rated to make, continuously carry and break 10 A at 110V AC and 1A (inductive) at 220V DC. Push button station shall have ‘stop’ push button or ‘start & stop’ push button
4.0	**PERFORMANCE PARAMETERS**		
4.1	Starting requirement		
a)	Minimum permissible voltage as a percentage of rated voltage, at start to bring the driven equipment upto the driven equipment upto rated speed		*The motors shall be capable of operation at full load at a supply voltage of 80% of the rated voltage for 5 minutes commencing from hot condition.*
b)	Maximum locked rotor current		as per IS 12615
c)	Starting duty		No. of consecutive cold startups : 3 (with initial temperature of the motor at ambient level) No. of consecutive hot startups : 2 (with initial temperature of motor at full load operating level)

d)	The locked rotor withstand time under hot condition at highest voltage limit		a) atleast 2.5 secs. more than starting time(for motors with starting time upto 20 secs. at minimum permissible voltage during starting) b)atleast 5 secs. more than starting time(for motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting) c) more than starting time by at least 10% of the starting time(For motors with starting time more than 45 secs.at minimum permissible voltage during starting) Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.
e)	The ratio of locked rotor KVA at rated voltage to rated KW		(a) Below 110KW : 10.0 (b) From 110 KW & upto 200 KW : 9.0
4.2	Torque (percent of full load torque)		1] Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque. 2]Pull out torque at rated voltage shall not be less than 205% of full load torque.
4.3	Noise level (max.)		85 dB(A)
4.4	Vibration shall be limited within the limits		as per IS:12075 IEC
5.0	**INSPECTION/TESTING**		
5.1	All type & Routine tests shall be as per attached quality plan		
5.3	In case the contractor is not able to submit valid report of the type test(s) or in case type test report(s) are not found to be meeting the specification requirements, or not including all specified tests the contractor shall conduct all such tests under this contract. The cost of such test shall be deemed to be included in the price. The owner shall have right to witness the type tests.		
5.4	All routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.		

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TECHNICAL DATA - PART - A

SL.NO	DESCRIPTION	UOM	DETAIL
1.0	**DESIGN CODES & STANDARDS**		
1.1	Impulse pipes, tubes (material, rating)		ANSI B31.1, ANSI B31.1a, ANSI/ISA 77.70
1.2	Valves (material, pr. Class, size)		ASTM A182/ASTM A105 as per ASME 16.34
1.3	Fittings (size, rating, material)		ANSI B31.1, ANSI B31.1a, ASME B16.11
1.4	Installation schemes		BS 6739-2009, ANSI/ISA 77.70
1.5	Fieldbus concepts		IEC 61158
1.6	Instruments and apparatus for pressure measurement		ASME PTC19.2
1.7	Electonic transmitters		BS-6447, IEC-60770
1.8	Bourdon tube pressure and vacuum gauges		IS-3624
1.9	Instrument and apparatus for temperature measurement		ASME PTC 19.3(1974)
1.10	Temperature measurement by electrical Resistance thermometers		IS:2806
1.11	RTD Sensor		IEC-751/ DIN-43760
1.12	Actuator		EN15714-2
1.13	**Codes for Orifice plate Design**		
	Orifice plate		ISO 5167
	Flange Standard for Orifice plate		ASME B16.36
2.0	**DESIGN /SYSTEM PARAMETERS**		
	ELECTRONIC TRANSMITTERS		
2.1	**DATASHEET - PRESSURE TRANSMITTER, DIFFERENTIAL PRESSURE TRANSMITTER, DP BASED FLOW AND LEVEL TRANSMITTER**		
	Output		Profibus PA complying to IEC 61158, digital output
	Turndown ratio		50:1
	Accuracy	%	0.06%
	Stability (% of calibrated range)	%	+/-0.25% for 10 year
	Diaphragm seal material		Suitable for process fluid
	Diagram fill fluid		Inert liquid
	Wetted parts		All wetted parts upto diaphragm seal shall be suitable for chemical application
	Housing		Metallic housing with durable corrosion resistant coating

	Protection		Weather proof IP-67
	Display		Integral digital display
	Diagonstic feature		Required
	Electrical connection		1/2" NPT (F)
	Manifold		2/3 valve non integral manifold for PT and 5 valve non integral manifold for DPT
	RTD & THERMOWELL		
2.2	**DATASHEET - RESISTANCE TEMPERATURE DETECTOR (RTD)**		
	Type		Four wire, Pt-100 (100 Ohms resistance at zero degree Centigrade).
	No. of element		Duplex
	Housing		Diecast Aluminium
	Protection Class		IP-65
	Head		Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter
	Plug in connectors		Required
	Terminal head		Spring loaded for positive contacts with the thermo well
	Insulation and sheathing		Mineral (magnesium oxide) insulation and SS316 sheath
	Calibration and accuracy		As per IEC-751/ DIN-43760 Class-A for RTD
	Accessories		Thermo well and associated fittings
2.3	**DATASHEET - THERMOWELL**		
	Design		One piece solid bored type of step-less tapered design
	Material		SS316
	LOCAL INSTRUMENTS / GAUGES		
2.4	**DATASHEET - PRESSURE GAUGE, DIFFERENTIAL PRESSURE GAUGE**		
	Sensing element		Bourdon for high pressure, diaphragm/bellow for low pressure
	Sensing element material		SS316
	Movement material		SS316
	Body material		SS316
	Dial size	mm	150mm

	End connection	inch	1/2 inch NPT (m)
	Accuracy		±1% of span
	Scale		Linear, 270° arc graduated in metric units
	Range selection	%	Cover 125% of max. of scale
	Over range Test pressure		Test pr. for the assembly shall be1.5 to the max. Design pr. at 38°C.
	Diaphragm seal material		Suitable for process fluid
	Diaphragm fill fluid		Inert liquid
	Wetted parts		All wetted parts upto diaphragm seal shall be suitable for process application
	Housing		IP-55
	Zero/span adjustment		External
	Identification		Engraved with service legend or laminated phenolic nameplate
	Accessories		Blow out disc, siphon, snubber, pulsation, dampener, chemical seal, gauge isolation valve
	PROCESS ACTUATED SWITCHES		
2.5	**COMMON REQUIREMENTS FOR PROCESS ACTUATED SWITCH**		
	Repeatability	%	+/-0.5% of full range
	No. of contacts		2 No.+2NC. SPDT snap action dry contact
	Rating of contacts		60 V DC, 6 VA
	Elect. Connection		Plug in socket.
	Set point adjustment		Provided over full range.
	Dead band adjustment		Adjustable/ fixed as per requirement of applicati
	Enclosure		IP-55
	Power Supply	V	24V DC
	FLOW ELEMENTS & FLOW METERS		
2.6	**DATASHEET - ROTAMETER**		
	Type		Variable area metal tube
	Fluid Media		Water / Oil
	Tube Media		SS316

	Material of Float		SS316
	Indicator		Linear scale
	Accessories		Flange, Orifice in case of bypass Rotameter (for line size above 100 mm}
	Housing protection class		IP-55
	Accuracy	%	± 2% of measured value
	SOLENOID VALVE, LIMIT SWITCHES		
2.7	**DATASHEET - SOLENOID VALVE**		
	Type		2/3/4 way SS 316/Forged Brass (depending on the application subject to Customer's approval during detailed Engg.)
	Power supply		24 V DC + 10%.
	Electrical connection		Plug and socket
	Insulation		Class 'H'
	IP Class		IP65
	Limit switches (for open/close feedback)		Required
2.8	**DATASHEET - LIMIT SWITCH**		
	Corrosion resistance		Silver plated with high conductivity and non corrosive
	Protection class		IP 55
	Contact rating		shall be sufficient to meet the requirement of DCS subject to a minimum of 60 V, 6 VA rating
2.9	**DATASHEET - JUNCTION BOX**		
	No. of ways		12/24/36/48/64/72/96/128
	Material and Thickness		4mm thick Fiberglass Reinforced Polyester(FRP)
	Type of terminal blocks		Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm2. A M6 earthing stud shall be provided.
	Protection Class		IP- 55 min. for indoor & IP-65 min for outdoor applications.
	Grounding		To be provided
	Color		RAL 7035
	Spare Terminals		At least 20% unused terminals
2.10	**Painting color scheme - Impulse piping for water area/equipment**		
	Impulse piping ground color scheme		Grey RAL 9002

	Identification Tag/band color scheme		Sea green, ISC no. 217
2.11	**DATASHEET - MOTORISED VALVE ACTUATOR**		
2.11.1	**General**		
	Duty		£ On / Off £ Inching
	Valve type		£ Globe £ Gate £ Reg. Globe £ Butterfly
	Ambient condition		Shall be suitable for continuous operation under an ambient temp. Of 0-60 deg c and relative humidity of 0-95%
2.11.2	**Construction and sizing**		
	Construction		Totally enclosed weather proof, minimum IP:68
	Mechanical position indicator		To be provided for 0-100% travel
	Bearings		Double shielded, grease lubricated anti-friction.
	Gear train for limit switch/torque switch operation		Metal (not fibre gears). Self-locking to prevent drift under torque switch spring pressure when motor is de-energized.
	Sizing		Open/close at rated speed against designed differential pressure at 90% of rated voltage. For isolating service three successive open-close operations or 15 mins. Whichever is higher. **For inching service - 150 starts/hr or required cycles whichever is higher.**
2.11.3	**Handwheel**		
	Required		¢ Yes £ No
	Orientation		£ Top Mounted £ Side Mounted
	Additional requirement		To disengage automatically during motor operation.
2.11.4	**Electric actuator**		
	Motor type		Squirrel cage induction motor suitable for Direct On-Line (DOL) Starting
	Power supply to motor / starter		415V +/- 10%, 3 Ph, 3W & 50Hz +/- 5%
	Control voltage requirement		To be derived from the Power Supply to the Starter £ 230 V ¢ 110 V AC / 24 V DC
	Enclosure class of motor		IP 68
	Insulation class		Class F. Temperature Rise 70 Deg C. Over 50 Deg C Ambient
	Winding temp protection		Thermostat (3 Nos.,1 In Each Phase)
	Single phasing protection & wrong phase sequence protection		Required, suitable means shall be provided to diagnose the type of fault locally.
2.11.5	**Integral starter**		
	Integral starter		Required with built in SPP (Single Phasing Preventer)
	Type of switching device		¢ Contactors £ Thyristors
	Type		Non-Intrusive Profibus Actuator
	Feature		All actuator settings including torque, limit shall be possible without opening the actuator cover.
	If smart		
	A) Serial link protocol		£ Foundation Field-Bus ¢ Profibus DP
	B) Redunadant profibus DP port	47	Required

	C) Hand held programmer		Not Required
	D) Profibus DP cable connection		Suitable connector integral to the actuator, or external devices/ accessories (mounted inside minimum IP65 protection class enclosure) shall be provided so that the actuator can be isolated online from the profibus network without disturbing the profibus communication of other actuators of the segment.
	E) Open/Close command termination logic		Shall be suitably built inside actuator
	F) GSD and DTM files		To be provided which shall be configured/ tested with DCS for proper interfacing and diagnostics
	G) Available signals to DCS (through profibus network)		Open/ close commands, open/ close feedback status, disturbance signal etc. along with diagnostics. The detailed diagnostics including the actuator operating data shall be available to the DCS
	Step down cont. Transformer		Required
	Open / close PB		Required
	Stop PB		Required
	Indicating lamps		Required
	Local remote s/s		Required (Lockable)
	Status contacts for monitoring		Required
2.11.6	**Position/ torque transmitter**		
	Position/torque transmitter		i. Position/limit measurement shall be done using absolute encoders which will give information of position/limit in both the
			ii. Electronic measurement of torque shall be provided.
	Supply		24V DC
	Accuracy		+ 1% FS
2.11.7	**Space heater**		
	Space heater		Required
	Power supply (non integral)		230V AC,1 Ph.,50 Hz
	Power supply (integral)		Power supply derived from main power supply available at actuator end
2.11.8	**Terminal block**		
	Actuator/motor terminal block		Required. For power cables, the grade of TBs shall be minimum 650V
	Terminals / connectors		Suitable terminals/ connectors, integral to actuator, for terminating fieldbus cables and power cables shall be provided
	Earthing terminal		Required (2nos.)
2.11.9	**Cable glands**		
	Type		Double Compression
	Material		Brass Material
	Armored fieldbus cable glands		Required
	Power cable glands		Required

2.11.10	**Wiring**		Suitable voltage grade copper wire
2.11.11	**LCD Display**		
	LCD Indication		Integral to actuator body
	Local display information		Regarding actuator alarms, status and valve position indications as a minimum.
2.11.12	**Motor considerations**		
	Power Supply		shall operate satisfactorily under the +/- 10% supply voltage variation at rated frequency, -6% to +4% variation in frequency at rated supply voltage, simultaneous variation in voltage & frequency the sum of absolute percentage not exceeding 10%.
2.11.13	**SIL certification**		SIL2
2.11.14	**Accessories**		
	Accessories for calibration / settings /		Required
2.12	**LOCAL INSTRUMENT ENCLOSURE AND LOCAL INSTRUMENT RACK**		
	Scope		LIE and LIR complete with all fittings, mountings & accessories, drains and utility lighting, cable & grounding cable etc.
	Construction		
	Rack	mm	1.6mm sheet plate
	Frame	mm	3mm thick channel frame of steel
	Free standing type		Yes
	Canopy		Yes, >=3mm thick steel, extended beyond the ends of the rack.
	Degree of Protection		IP-55 for LIE & JB of LIE/LIR
	Junction Box		Applicable
3.0	**INSPECTION/TESTING**		
3.1	Type Test requirement		Yes
	Item-1		Electronic Transmitters
	Test & Standard -1		As per Standard, BS-6447 / IEC-60770
	Test to be specifically conducted		No
	NTPC’s approval required. on Test certificate		Yes

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TECHNICAL DATA - PART - B FOR PUMP (SUPPLIER DATA TO BE FURNISHED AFTER AWARD OF CONTRACT)

SL.NO	DESCRIPTION	UOM	DETAIL
1.0	**GENERAL**		
1.1	Designation of the Pump		
1.2	Manufacturer		
1.3	Model No.		
1.4	No. of pumps		
1.5	System Design Pressure	Nos.	
1.6	Specific Gravity of fluid to be handled	Kg/cm^2	
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	Pump Bowl Head	MWC	
2.5	Shut off head	MWC	
2.6	Range of Operation of the Pump		
	a) Min.Flow	M^3/hr	
	b) Max.Flow	M^3/hr	
2.7	The pumps offered have continuously rising head capacity curves from the duty point towards shut off point.		
2.8	The pumps offered have stable rising H-Q curves within the "Range of Operation"		
2.9	Pump rated speed	RPM	
2.10	Vibration measurements (2.9.2 is applicable in addition to 2.9.1 for Pumps with speed less than 600 RPM)		
2.10.1	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	
2.10.2	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	
2.11	Max. noise Level (Guaranteed at site)	dB	
2.12	Guaranteed Pump efficiency at rated head & rated capacity without -ve tolerance	%	
2.13	Bowl Efficiency	%	

2.14	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	
2.15	Minimum Submergence required above the suction bell at duty point (mm)	MWC	
3.0	**DESIGN & CONSTRUCTION FEATURES**		
3.1	Type of pump		
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		
3.8	Specific speed $N = \frac{RPM \times (Flow\ in\ USGPM)^{1/2}}{(Head\ in\ Ft.)^{3/4}}$		
3.9	Minimum Submergence required above the suction bell for pump operation at maximum discharge point within the 'Range of Operation' specified		
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 (Thrust)		
	a) Type and manufacturer		
	b) Bearing no.		
	c) Type of lubrication		
	d) Design life (Hrs.)		
3.13	Bearing (Line Shaft)		
	a) Quantity		
	b) Type and manufacturer		
	c) Bearing no.		
	d) Type of lubrication		
	e) Design life (Hrs.)		
3.14	Shaft Sealing arrangement		
	a) Type and Make/Model details		
	b) Sealing liquid		
	c) Requirement of external water if any		

	i) Quality		
	ii) Quantity/ Pump	M^3/hr	
3.15	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.		
3.16	Critical Speed of Pump Rotating Assembly	RPM	
4.0	**MATERTIAL OF CONSTRUCTION (Indicate applicable code/ standard)**		
4.1	Casing & Suction Bell		
4.2	Impeller		
4.3	Shaft		
4.4	Shaft sleeves		
4.5	Column Pipe		
4.6	Wear ring		
4.7	fasteners (Wetted/Others)		
4.8	Gland		
4.9	Lantern ring		
4.10	Line Shaft Bearing		
4.11	Line Coupling		
4.12	Mechanical seals (faces)/ (If applicable)		
	Gland packing		
4.13	Thrust Pad		
4.14	Base plate		
5.0	**CONNECTIONS AND OTHER DIMENSIONAL DETAILS**		
5.1	Impeller diameter	mm	
5.2	Minimum Water Level	M	
5.3	Maximum Water Level	M	
5.4	Column pipe OD x Thickness (mm)	mm	
5.5	No. of Column pieces		
5.6	No. of intermediate shaft		
5.7	No. of intermediate shaft		
6.0	**DRIVE DATA**		
6.1	Drive unit output at 50^{o}C ambient condition	KW/ P	
7.0	**INSPECTION & TESTING**		
7.1	Material test		
7.2	Hydrostatic test pressure	Kg/cm^2	
7.3	Hydrostatic test duration	Min.	
7.4	Performance test on pump at shop		
7.5	Dyanamic balance test		
8.0	**WEIGHT AND LOADING DATA**		
8.1	Weight of the pump & drive assembly (Static/Dynamic)	Kg	
8.2	Weight of the heaviest piece to be handled	Kg	
8.3	Size of base plate (length x width)	mm	

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TECHNICAL DATA - PART - B (SUPPLIER DATA TO BE FURNISHED AFTER AWARD OF CONTRACT)

SL.NO		UOM	DETAIL
1.0	**GENERAL**		
i)	Manufacturer & Country of origin.		
ii)	Equipment driven by motor)		
iii)	Motor type		
iv)	Country of origin		
v)	Quantity	nos.	
2.0	**DESIGN AND PERFORMANCE DATA**		
i)	Frame size		
ii)	Type of duty		
iii)	Type of enclosure and method of cooling		
vi)	Type of mounting		
vii)	Direction of rotation as viewed from DE END		
viii)	Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard	(KW)	
ix)	(A) Derated rating for specified normal condition i.e. 50 deg. C ambient temperature	(KW)	
	(B) Rating as specified in load list	(KW)	
xi)	Rated speed at rated voltage and frequency	rpm	
xii)	At rated Voltage and frequency		
	a) Full load current	A	
	b) No load current	A	
xiii)	Power Factor at		
	a) 100% load		
	b) At duty point		
	c) 75% load		
	d) 50% load		
	e) NO load		
	f) Starting.		
xiv)	Efficiency at rated voltage and frequrecy		
	a) 100% load		
	b) At duty point		
	c) 75% load		
	d) 50% load		
xv)	Starting current*(inclusive of IS tolerance)* at		
	a. 100 % voltage	A	
	b. Minimum starting voltage	A	
xvi)	Starting time with minimum permissible voltage		
	a. Without driven equipment coupled	sec	
	b. With driven equipment coupled	sec	
xvii)	Safe stall time with 110% of rated voltage		
	a. From hot condition	sec	
	b. From cold condition	sec	
xviii)	**Torques :**		
	a. Starting torque at min. permissible voltage	(kg-mtr.)	
	b. Pull up torque at rated voltage.	(kg-mtr.)	
	c. Pull out torque	(kg-mtr.)	
	d. Min accelerating torque available	(kg-mtr.)	

	e. Rated torque	(kg-mtr.)	
xix)	Stator winding resistance per phase (at 20 Deg.C.)	Ohm	
xx)	GD^2 value of motors		
xxi)	Locked rotor KVA input (at rated voltage)		
xxii)	Locked rotor KVA/KW.		
xxiii)	**Bearings**		
	a. Type		
	b. Manufacturer		
	c. Self Lubricated or forced Lubricated		
	d. Recommended Lubricants		
	e. Guaranteed Life in Hours		
	f. Whether Dial Type thermometer provided		
	g. Oil pressure Gauge/switch		
	i. Range		
	ii. Contact Nos. & ratings		
	iii. Accuracy		
xxiv)	**Vibration**		
	a) Velocity	mm/s	
	b) Displacement	microns	
xxv)	Noise level	db	
3	**CONSTRUCTIONAL FEATURES**		
i	Stator winding insulation		
	a. Class & Type		
	b. Tropicalised (Yes/No)		
	c. Temperature rise over specified max.		
	i. Cold water temperature of 38 DEG. C.		
	ii. Ambient Air 50 DEG. C.		
	d. Method of temperature measurement		
	e. Stator winding connection		
	f. Number of terminals brought out		
ii	Type of terminal box for		
	a. stator leads		
	b. space heater		
	c. Temperature detectors		
	d. Instrument switch etc.		
iii)	For main terminal box		
	a. Location		
	b. Entry of cables		
	c. Recommended cable size		
	d. Fault level	MVA	
iv)	Temperature detector for stator winding		
	a Type		
	b. Nos. provided		
	c . Location		
	d. Make		
	e. Resistance value at 0 deg. C	ohms	
vi)	Paint shade		
vii).	Weight of(approx)		
	a. Motor stator (KG)		
	b. Motor Rotor (KG)		
	c. Total weight (KG)		
4	Relevant motor curves		

TECHNICAL DATA - PART - B (SUPPLIER DATA TO BE FURNISHED AFTER AWARD OF CONTRACT FOR EACH INSTRUMENT/ SOV / JB)

SL.NO	DESCRIPTION	UOM	DETAIL
1.0	MAKE		
1.1	MODEL		
1.2	TAG NO. / KKS NO.		
1.3	SERVICE		
1.4	QUANTITY		
1.5	OPERATING PRESSURE		
1.6	OPERATING TEMPERATURE		
1.7	DESIGN PRESSURE		
1.8	DESIGN TEMPERATURE		
1.9	RANGE		

COMPLIANCE DRAWING

1 WATER ANALYSIS

2 ELECTRICAL SCOPE SPLIT

3 C&I DRAWINGS

4 PID OF PLANT WATER SYSTEM

5 MECHANICAL GA OF PUMP HOUSE

	TECHNICAL SPECIFICATION MISC. PUMPS (VERTICAL) 2X800 MW LARA STAGE-II & 2X800 SINGRAULI STAGE-III			PE-TS-508/512-100-W002 Rev. No. 00 Date : 14.08.25
	A.	**Passivated DM WATER ANALYSIS:**		
SL. NO.				
	Conductivity:	Less than 0.1 microS/cm		
	Total silica:	Less than 0.02 ppm		
	pH:	8.5 to 9.5		

SL. NO.	**UNIT**	**Parameters**	**RAW WATER ANALYSIS**	
			LARA 2X800 MW	**SINGRAULI 2X800 MW**
1		pH	7.6-8.5	7-8.3
2	NTU	Turbidity	500	500
3	mg/l as $CaCO_3$	P-Alkalinity	--	--
4	mg/l as $CaCO_3$	M-Alkalinity	155.18	150
5	mg/l as $CaCO_3$	Total Hardness	256.5	162
6	mg/l as $CaCO_3$	Calcium	172.5	117
7	mg/l as $CaCO_3$	Magnesium	84	45
8	mg/l as Cl	Chloride	42.82	30
9	mg/l as SO_4	Sulphate	115.5	32
10	mg/l as SiO_2	Total Silica	25	35
11	mg/l as SiO_2	Colloidal Silica	5	15
12	mg/l as SiO_2	Reactive Silica	20	20
13	mg/l as Na	Sodium + Potassium	25	50
14	mg/l	Total Organic Carbon (TOC)	5	5
15	mg/l	Chemical Oxygen Demand (COD)	15	50
16	mg/l	Biological Oxygen Demand (BOD)	5	5
17	mg/l	Equivalent Mineral Acid (EMA)	158.32	62
18	mg/l	Total Suspended Solids (TSS)	--	--
19	mg/l as Fe	Total Iron	0.3	3
20	mg/l	$KMnO_4$ No.	BDL	BDL
21	mg/l	Dissolved Oxygen (DO)	7 TO 8	upto 5
22	Deg C	Temperature	28-36	28-36
23	ppm	TDS	476	450
24	mg/l as $CaCO_3$	Total cations	313	212
25	mg/l as $CaCO_3$	Total anions	313	212

REV: 0 DATE: 08.07.2025

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

PACKAGE: MISC. PUMP

PROJECT: 2X800 MW LARA STAGE-II & 2X800 SINGRAULI STAGE-III

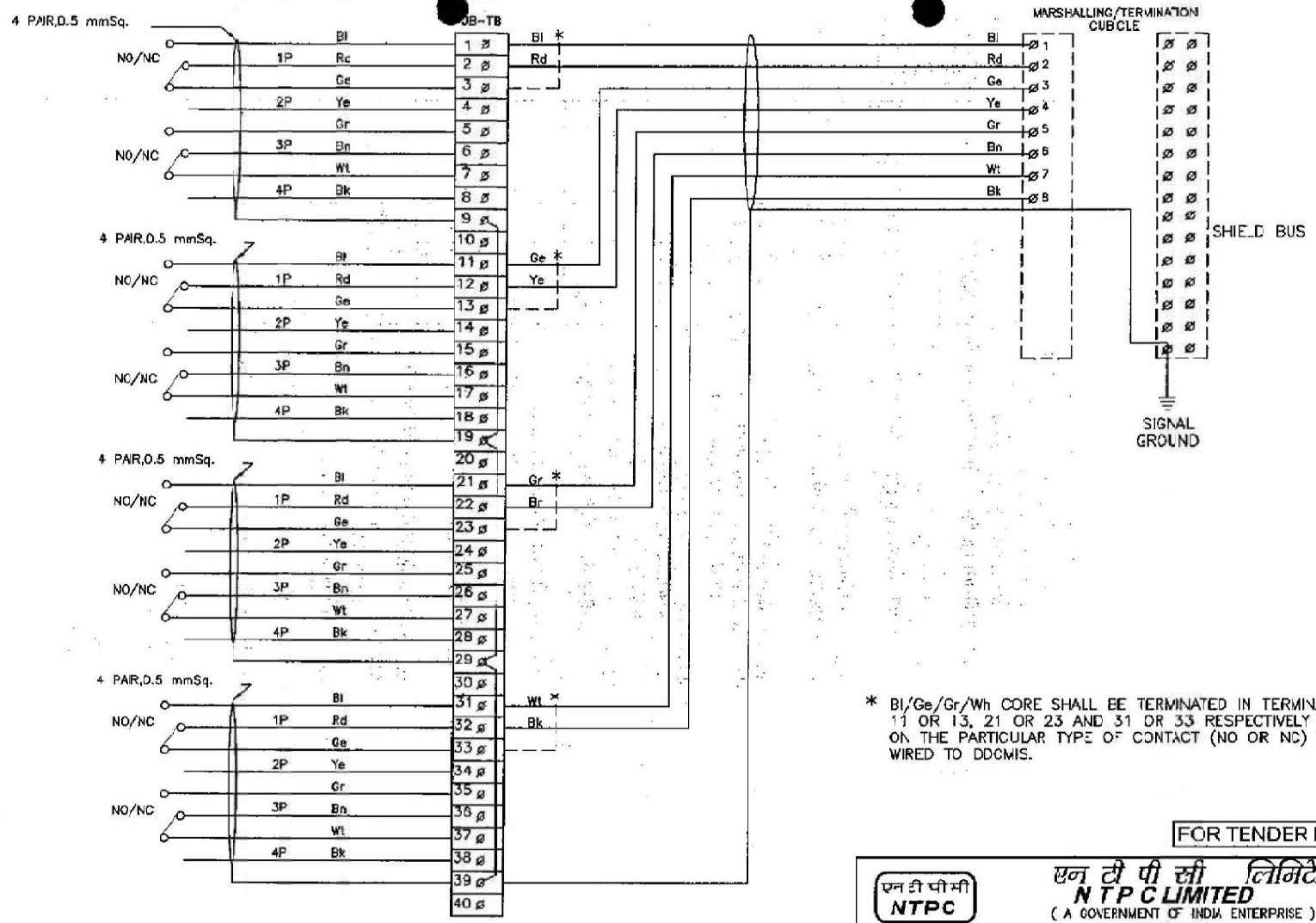
S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415 V MCC	BHEL	BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required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

NOTES:

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

PACKAGE: MISC. PUMP

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



* Bl/Ge/Gr/Wh CORE SHALL BE TERMINATED IN TERMINAL 1 OR 3, 11 OR 13, 21 OR 23 AND 31 OR 33 RESPECTIVELY DEPENDING ON THE PARTICULAR TYPE OF CONTACT (NO OR NC) IS TO BE WIRED TO DDCMIS.

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NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

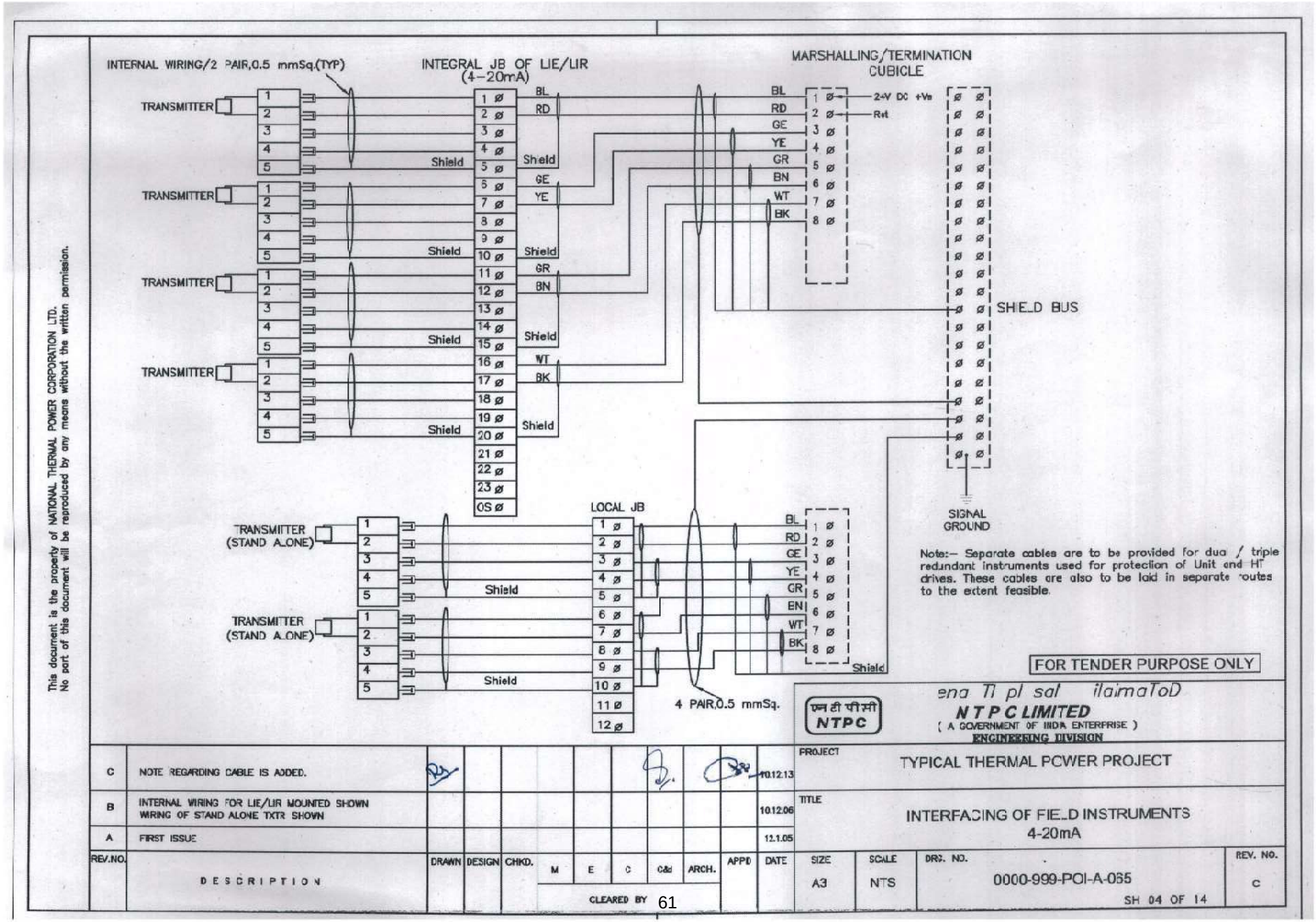
PROJECT: TYPICAL THERMAL POWER PROJECT

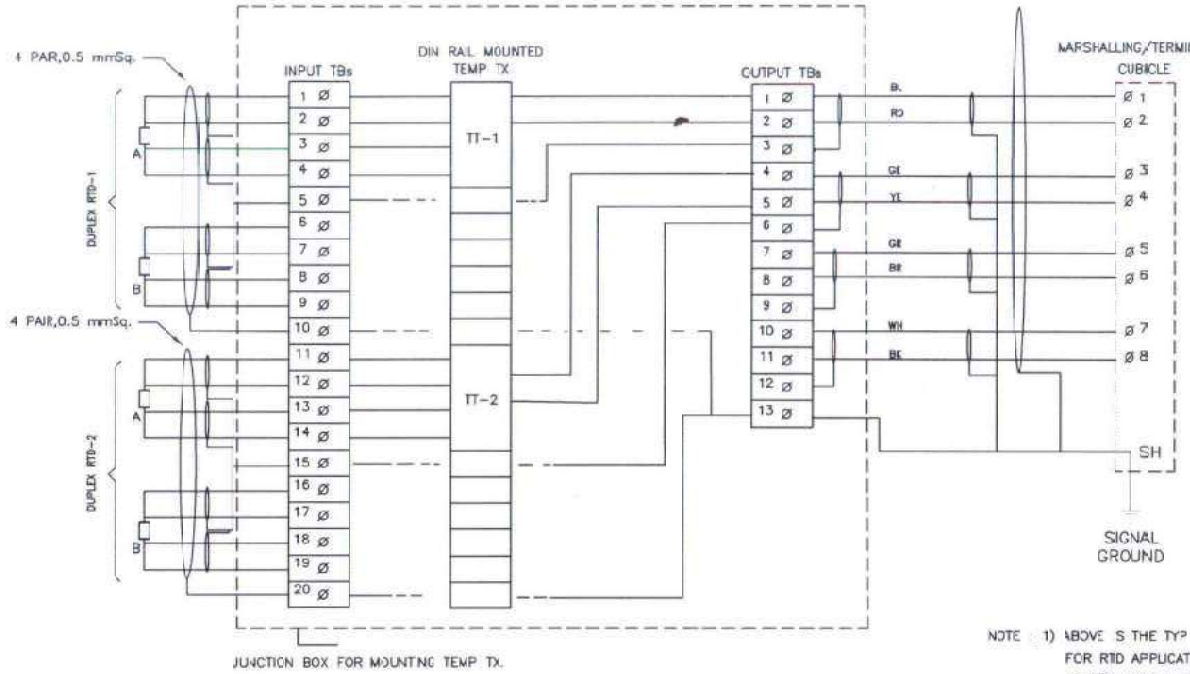
TITLE: INTERFACING OF FIELD INSTRUMENTS
SWITCH TERMINATION DETAILS
NO/NC

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	APPD	DATE
A	FIRST ISSUE					29.04.06

CLEARED BY: M | E | C | C&I | ARCH.

SIZE	SCALE	DRG. NO.	REV. NO.
A3	NTS	0000-999-POI-A-065 SH 02 OF 14	A





NOTE : 1) ABOVE IS THE TYP DRG. FOR DIN RAIL MOUNTED TEMP TRANSMITTERS FOR RTD APPLICATION. EXACT TYPE OF TEMP TRANSMITTER SHALL BE AS PER PART-A OF SPECIFICATION.
2) THE EXACT GROUPING OF TEMP TXs SHALL BE FINALISED DURING DETAILED ENGG. STAGE.

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(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

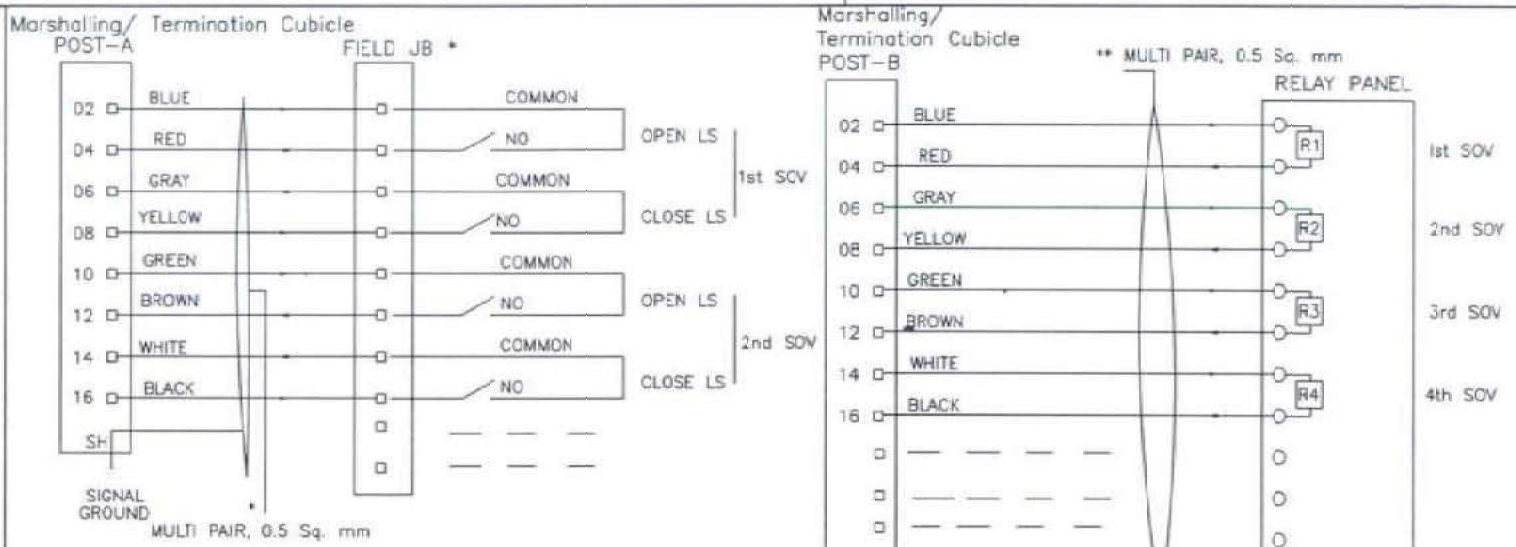
PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INTERFACING OF FIELD INSTRUMENTS
TYPICAL RTD CONNECTION WITH TEMP TRANSMITTERS IN JBs

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE										25.04.06

CLEARED BY

SIZE	SCALE	DRG. NO.	REV. NO.
A3	NTS	0000-999-POI-A-065 SH 06 OF 14	C



1) * FEEDBACKS OF SOVs CAN BE GROUPED IN FIELD JB AND MULTI PAIR CABLE IS TO BE USED FROM FIELD JB TO MARSHALLING/TERMINATION CUBICLE FOR FEEDBACKS OF GROUP OF SOVs. TYP ARRANGEMENT IS SHOWN FOR A GROUP OF TWO SOVs WITH OPEN AND CLOSE LIMIT SWITCHES.

2) NO. OF LIMIT SWITCHES/NC. OF CONTACT IN LIMIT SWITCHES SHALL BE PROVIDED FOR EACH VALVE AS PER SPEC. REQUIREMENT/ PHILOSOPHY FOR RESPECTIVE SYSTEM.

3) ** MULTIPAIR CABLE IS TO BE USED FOR CONNECTION OF COMMAND OUTPUTS FROM MARSHALLING/TERMINATION CUBICLE TO RELAY PANEL FOR A GROUP OF SOVs.

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National Thermal Power Corporation Ltd.
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

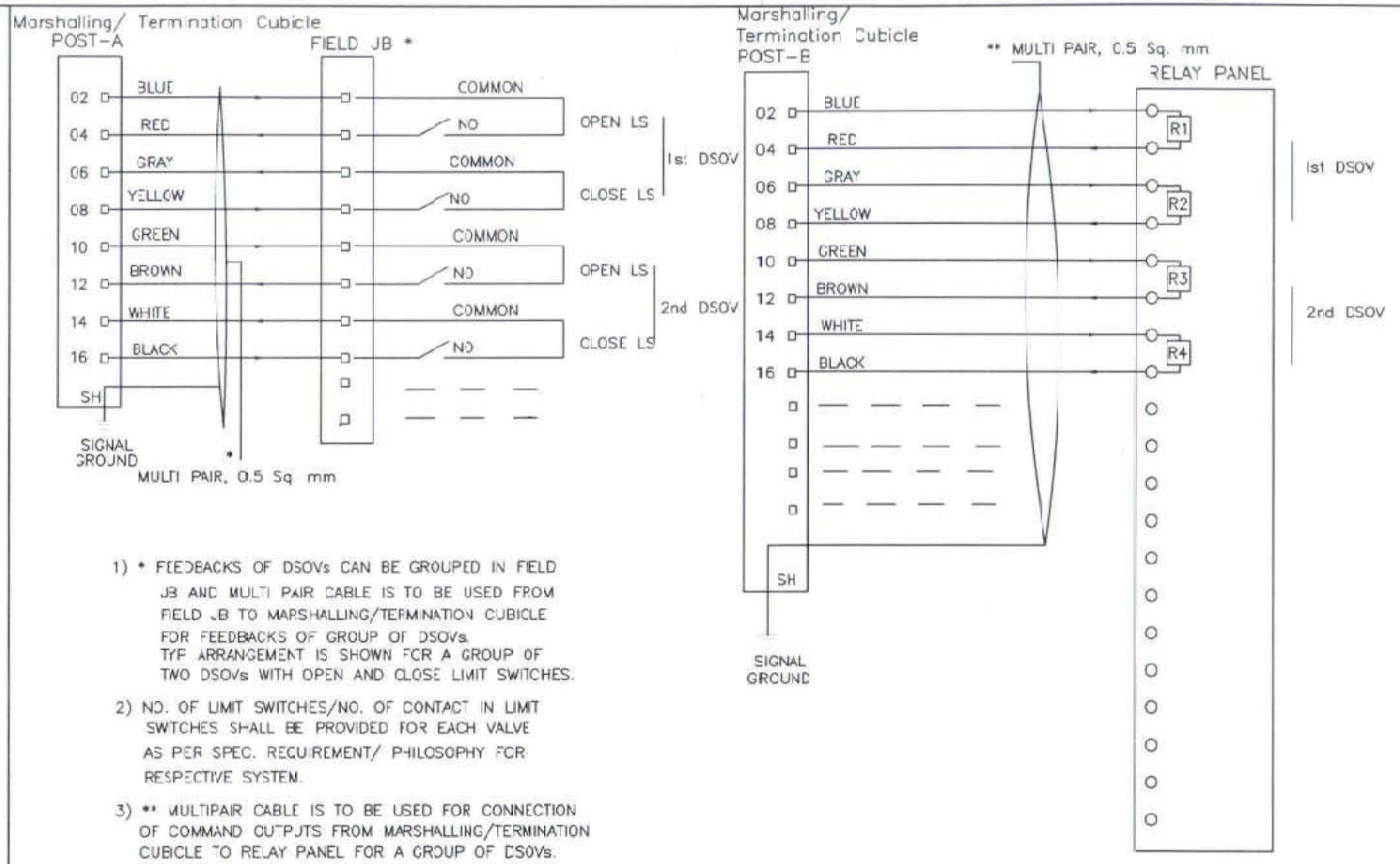
PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INTERFACING OF FIELD INSTRUMENTS
INTERFACE OF DDCMIS WITH MCC/SWGR/ACTUATOR
(SINGLE COIL SOLENOID)

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
B	FIRST ISSUE										30.10.02

CLEARED BY

SIZE	SCALE	DRG. NO.	REV. NO.
A3	NTS	0000-999-POI-A-065 SH 08 OF 14	C



1) * FEEDBACKS OF DSOVs CAN BE GROUPED IN FIELD JB AND MULTI PAIR CABLE IS TO BE USED FROM FIELD JB TO MARSHALLING/TERMINATION CUBICLE FOR FEEDBACKS OF GROUP OF DSOVs. TYP ARRANGEMENT IS SHOWN FOR A GROUP OF TWO DSOVs WITH OPEN AND CLOSE LIMIT SWITCHES.

2) NO. OF LIMIT SWITCHES/NO. OF CONTACT IN LIMIT SWITCHES SHALL BE PROVIDED FOR EACH VALVE AS PER SPEC. REQUIREMENT/ PHILOSOPHY FOR RESPECTIVE SYSTEN.

3) ** MULTIPAIR CABLE IS TO BE USED FOR CONNECTION OF COMMAND OUTPUTS FROM MARSHALLING/TERMINATION CUBICLE TO RELAY PANEL FOR A GROUP OF DSOVs.

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नैशनल थर्मल पावर कारपोरेशन लिमिटेड
National Thermal Power Corporation Ltd
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

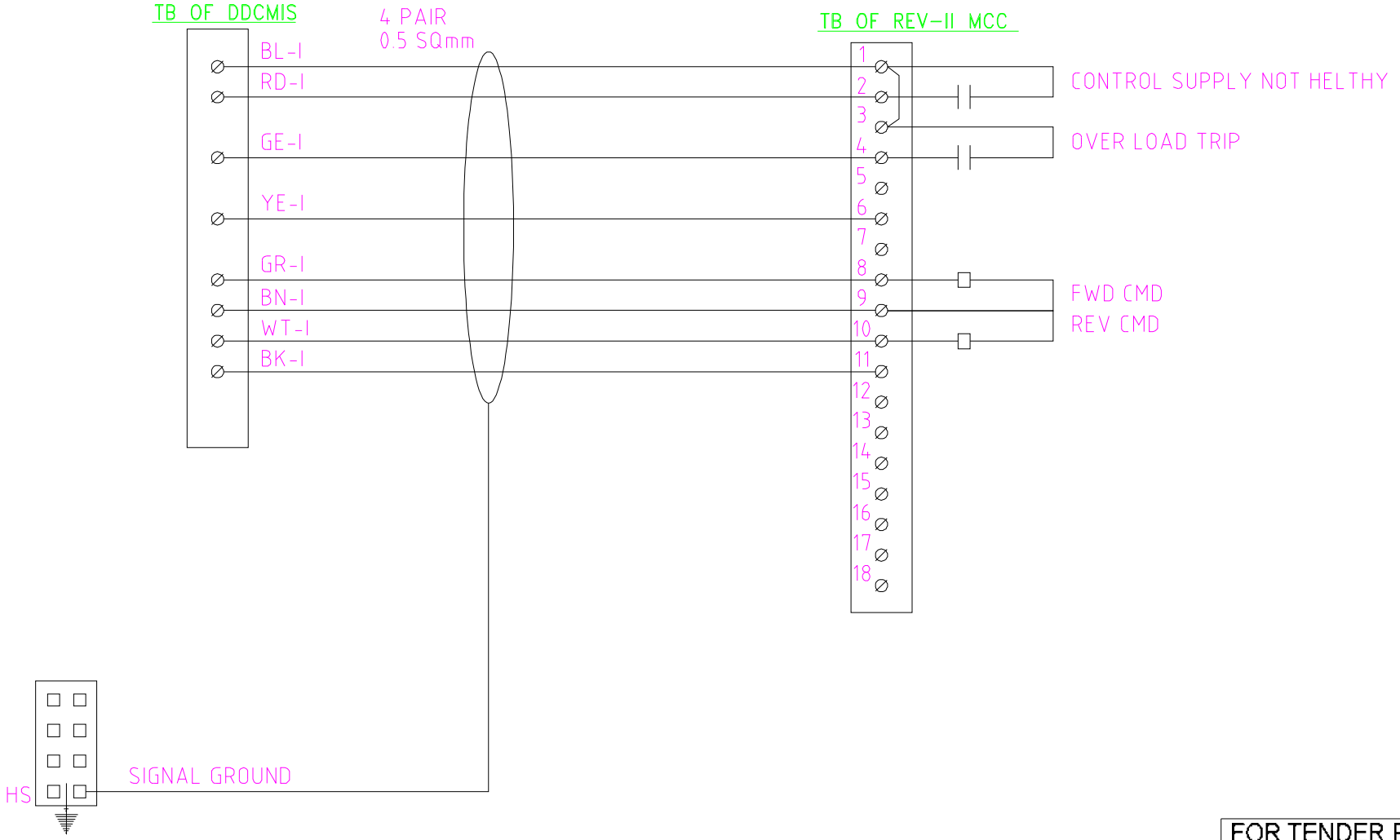
PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INTERFACING OF FIELD INSTRUMENTS
INTERFACE OF DDCMIS WITH MCC/SWGR/ACTUATOR
(DOUBLE COIL SOLENOID)

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
B	FIRST ISSUE										30.10.02

CLEARED BY

SIZE	SCALE	DRG. NO.	REV. NO.
A3	NTS	0000-999-FOI-A-065 SH 09 OF 14	C



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National Thermal Power Corporation Ltd.

(A GOVERNMENT OF INDIA ENTERPRISE)

ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT CHP

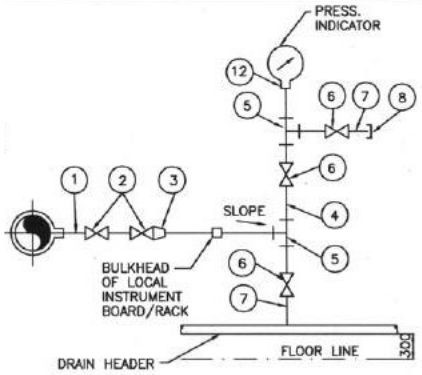
TITLE: INTERFACE OF DDCMIS WITH MCC /SWGR/LCP (REV-II)

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE										11.01.17

CLEARED BY

65

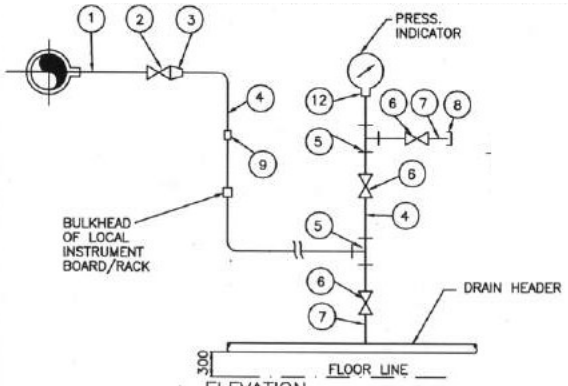
SIZE	SCALE	DRG. NO.	REV. NO.
A3	N.T.S.	0000-155-POI-A-065 SH 07	A



ELEVATION
LIQUID SOURCE
(GAUGE MOUNTED ABOVE INSTRUMENT SOURCE POINT)

LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	1/2" , 3/4" , 1" NPS SCH 40/80/160/XXS/P91 (AS PER PROCESS REQUIREMENT) NIPPLE OF MATERIAL SAME AS THAT OF MAIN PIPE.
2.	1/2"/3/4"/1' SW GLOBE VALVE/GATE VALVE
3.	3/4" / 1" x 1/2" SW REDUCING INSERT
4.	1/2" / 3/4" PIPE
5.	1/2" / 3/4" SW EQUAL TEE
6.	1/2" / 3/4" SW GLOBE VALVE.
7.	1/2" / 3/4" NPS SW x 1/2" / 3/4" NPT(M) CARBON/ALLOY STEEL NIPPLE.
8.	1/2" / 3/4" NPT(F) CAP.
9.	1/2" / 3/4" PIPE UNION.
10.	6" SS SYPHON
11.	1/2" BLIND 300lbs RF ANSI FLANGE DRILLED AND TAPED FOR 1" NPT PIPE.
12.	SUITABLE ADAPTER.
13.	1/4" CHROME MOLY STEEL TUBE.
14.	
15.	1"/3/4" SW EQUAL TEE.
16.	DIAPHRAGM(WAFER ELEMENT)
17.	ISOLATION VALVE 316 SS,1/4"SW



ELEVATION
LIQUID SOURCE
(GAUGE MOUNTED BELOW INSTRUMENT SOURCE POINT)

NOTES:-

1. THE MATERIAL SPECIFICATION AND SCHEDULE NO. OF IMPULSE PIPE & NIPPLE AS LISTED HEREIN SHALL BE AS PER TECHNICAL SPECIFICATIONS.
2. THE MATERIAL SPECIFICATION AND RATING OF FITTINGS AS LISTED SHALL BE AS PER SPECIFICATIONS. WELDED/THREADED FITTINGS SHALL CONFIRM TO ANSI-B.16-11.
3. INSTRUMENTS VALVES BODY STEM MATERIAL AND PRESSURE CLASS SHALL BE AS PER TECHNICAL SPECIFICATIONS.
4. FOR BOILER AIR/FLUE GAS SERVICES SOURCE CONNECTIONS IMPULSE PIPING AND ALL FITTINGS SHALL BE OF 3/4" NB SIZE.
5. GAUGES SHALL NOT BE MOUNTED ON THE PIPE. IT WILL BE MOUNTED ON A CHANNEL OR FRAME OR A RACK..
6. * SLOPE APPROX. 50 MM / METRE.

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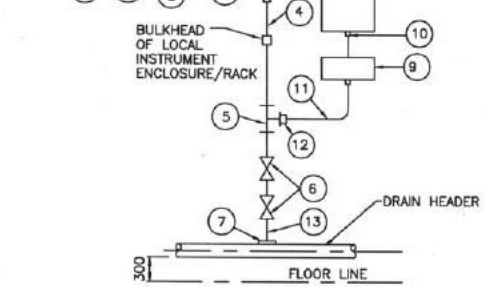
PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INSTRUMENT INSTALLATION DIAGRAM (FOR PRESSURE GAUGE)

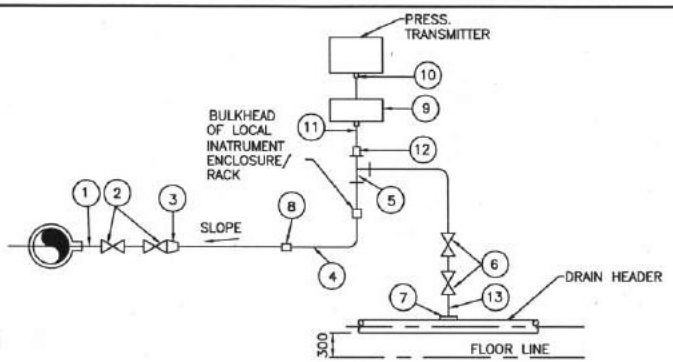
REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE							T.G.			21.08.12
		CLEARED BY									

SIZE	SCALE	DRG. NO.	REV. NO.
A3	N.T.S.	0000-999-POI-A-022	A



ELEVATION

TRANSMITTER MOUNTED BELOW INSTRUMENT SOURCE POINT



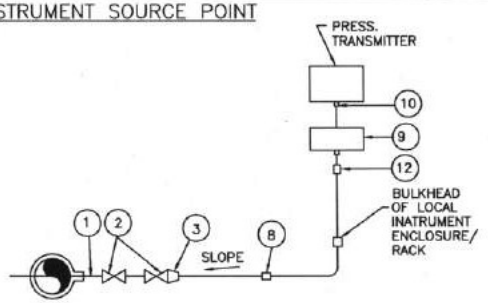
ELEVATION

TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT

LIQUID PRESSURE MEASUREMENT

LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	1/2" / 3/4" /1" NPS SCH. 80/160/XXS/P91 NIPPLE OF MATERIAL SAME AS THAT OF MAIN PIPE.
2.	3/4"/1" SW GLOBE VALVE.
3.	3/4"/1" TO 1/2" REDUCING INSERT
4.	1/2" NPS PIPE
5.	1/2" SW EQUAL TEE
6.	1/2"SW GLOBE VALVE
7.	1/2"NPS SCH. 80/160 SWx1/2"CS/AS COUPLER
8.	1/2" PIPE UNION
9.	2/3 VALVE MANIFOLD (FOR DETAIL SEE DRAWING NO.0000-102-POI-A-023.
10.	SUITABLE ADAPTER
11.	SS TUBE
12.	1/2" PIPE x 1/2"TUBE UNION
13.	1/2"NPS SCH. 80/160 SWx1/2" NPT(M) CS/AS NIPPLE



ELEVATION

VACCUM PRESSURE MEASUREMENT

NOTES:-

1. SAME NOTES UNDER DRG. NO. 0000-999-POI-A-023.
2. FOR VACUUM APPLICATION OTHER PORT OF TRANSMITTER SHALL BE KEPT OPEN TO ATMOSPHERE.

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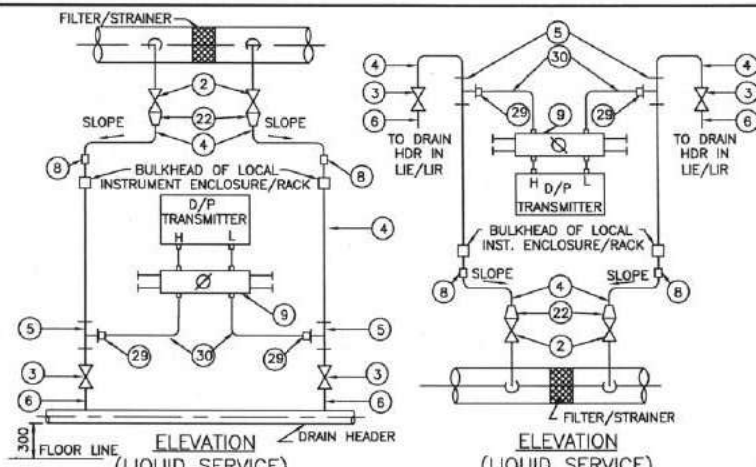
REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
					CLEARED BY						
A	FIRST ISSUE							T.G.			21.08.12

PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INSTRUMENT INSTALLATION DIAGRAM (PRESSURE MEASUREMENT USING PRESS /DP TRANSMITTERS STEAM/LIQUID VACUUM)

SIZE	SCALE	DRG. NO.	REV. NO.
A3	N.T.S.	0000-999-POI-A-025	A

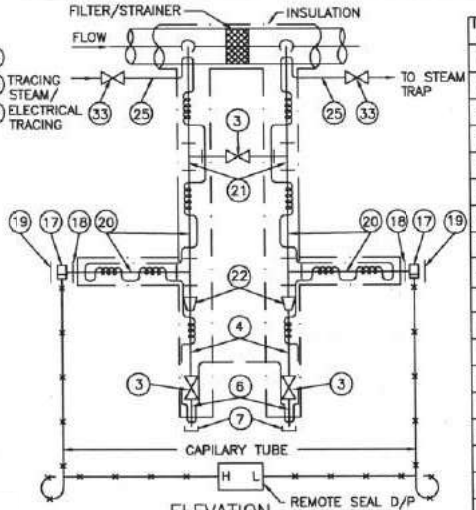


ELEVATION
(LIQUID SERVICE)

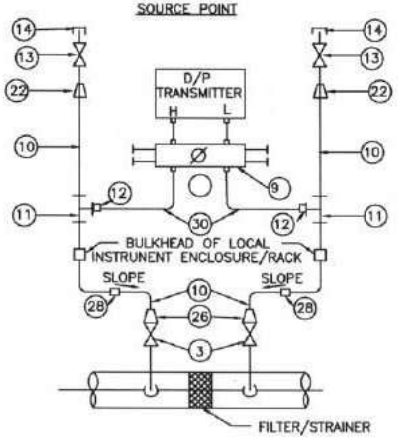
TRANSMITTER MOUNTED BELOW INSTRUMENT SOURCE POINT

ELEVATION
(LIQUID SERVICE)

TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT



ELEVATION
OIL SERVICE



ELEVATION
CLEAN GAS/AIR SERVICE

TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT
DIFFERENTIAL PRESSURE MEASUREMENT

1. SAME NOTES AS UNDER DRG. NO. 0000-999-POI-A-023.

FOR TENDER PURPOSE ONLY

LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	42x2 TO 3/4" SW REDUCING INSERT.
2.	3/4" SW GLOBE VALVE.
3.	1/2" SW GLOBE VALVE FOR LIQUID APPLICATION & 3/4"/1" IN GAS/AIR APPLICATION
4.	1/2" NPS 40/80/160 (AS PER PROCESS REQUIREMENT) CARBON/ALLOY STEEL PIPE.
5.	1/2" SW EQUAL TEE.
6.	1/2" NPS SW x 1/2" NPT (M) NIPPLE.
7.	1/2" NPT (F) CAP.
8.	1/2" PIPE x 1/2" PIPE UNION.
9.	5 VALVE MANIFOLD (FOR DETAIL REFER DRAWING NO.0000-999-POI-A-026.
10.	3/4" SCH 80 CARBON/ALLOY STEEL PIPE.
11.	3/4"/1/2" SW EQUAL TEE.
12.	3/4"x1/2" TUBE UNION.
13.	1/2" SCREWED GLOBE VALVE.
14.	1/2" NPT (M) PLUG.
15.	3/4" SW GATE VALVE.
16.	3/4" SW EQUAL CROSS.
17.	WAFER ELEMENT FOR USE WITH 3"ANSI R.F. VALVE.
18.	3"BLIND 300lbs R.F. WELD NECK FLANGE DRILLED FOR 1" SCH. 40/80 PIPE.
19.	3" BLIND FLANGE.
20.	1"NPS SCH. 40/80 (AS PER PROCESS REQUIREMENT) CS PIPE.
21.	1" SW EQUAL TEE.
22.	3/4" x 1/2"SW REDUCING INSERT.
23.	3/4" SW x 3/4" NPT (M) CS/AS NIPPLE
24.	3/4" NPT (F) CS/AS CAP.
25.	1/4" NPS ALLOY STEEL PIPE.
26.	1" x 3/4" SW REDUCING INSERT.
27.	3/4" SW x 1/2" PSW BRANCH TEE.
28.	3/4" PIPE UNION
29.	1/2" CLAMP UNION (THREADED) SUITABLE FOR FLEXIBLE CONNECTION OF NYLON REINFORCED PVC TUBE.
30.	SS TUBE
31.	3/4" SW 4 WAY VALVE.
32.	QUICK DISCONNECT FITTINGS.
33.	1/4" SW ISOLATION VALVE 316SS
34.	1/2" x 1/2" SS PIPE UNION.

एन टी पी सी NTPC

N T P C LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT

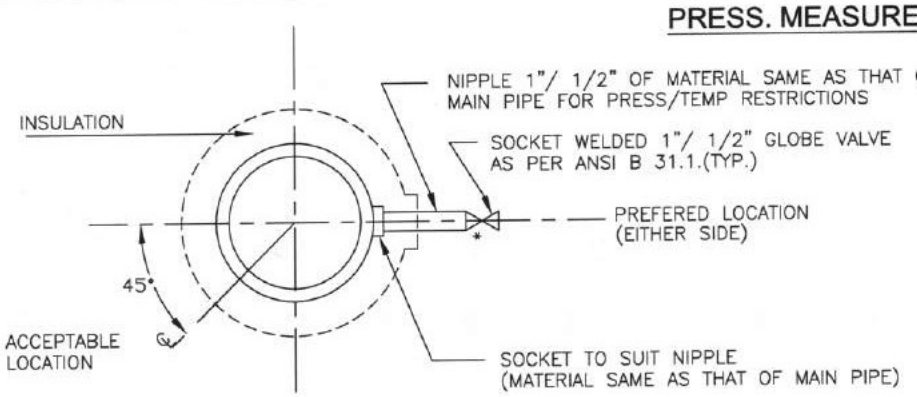
TITLE: INSTRUMENT INSTALLATION DIAGRAM
DIFF. PRESS.MEASUREMENT (LIQUID, OIL, AIR/GAS SERVICE)

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE							T.G.			21.08.12

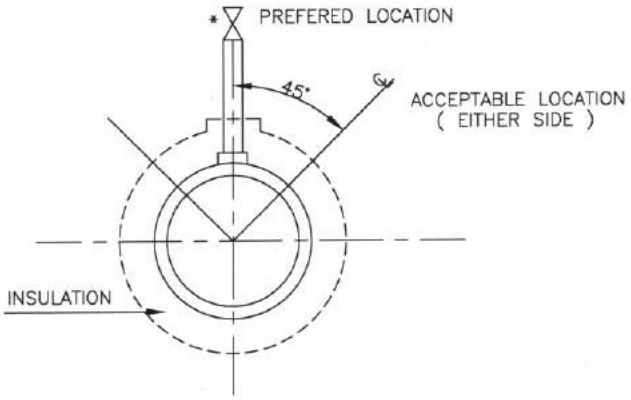
CLEARED BY

SIZE	SCALE	DRG. NO.	REV. NO.
A3	N.T.S.	0000-999-POI-A-030	A

PRESS. MEASUREMENT

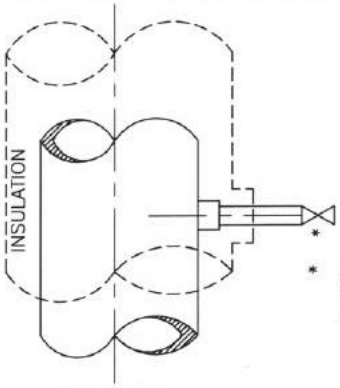


ELEVATION
LIQUID SERVICE



ELEVATION
STEAM SERVICE

PRESSURE CONNECTION ON HORIZONTAL PIPE



* USE DOUBLE ISOLATION VALVES FOR PRESSURE EQUAL TO OR EXCEEDING 40 Kg/Cm2.

ELEVATION
LIQUID OR STEAM SERVICE

PRESSURE CONNECTIONS ON VERTICAL PIPES

FOR TENDER PURPOSE ONLY

NTPC — N T P C LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD.	DATE
A	FIRST ISSUE							T.G.			21.08.18

CLEARED BY

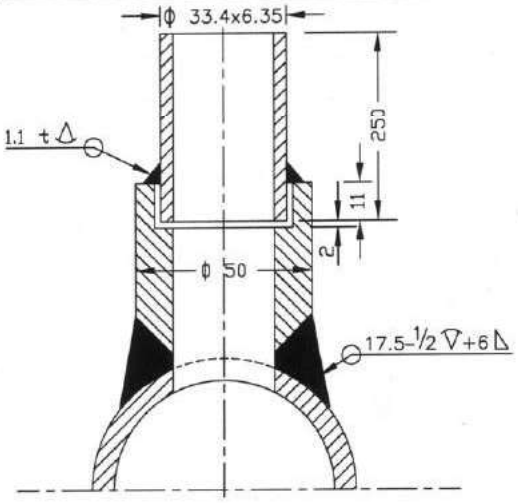
PROJECT: TYPICALTHERMAL POWER PROJECT

TITLE: INSTRUMENT SOURCE CONNECTION DETAILS

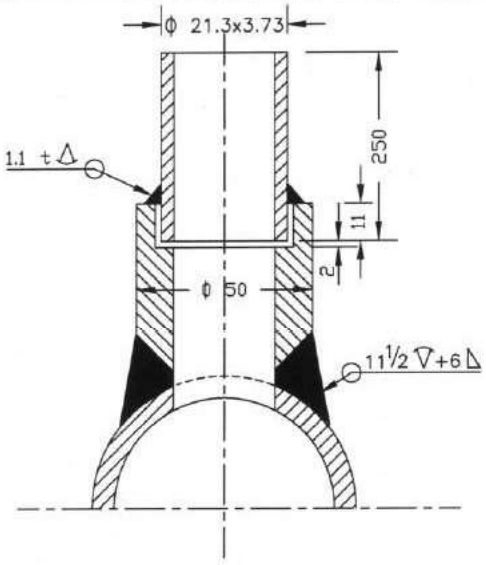
SIZE	SCALE	DRG. NO.	REV. NO.
A4	N.T.S.	0000-999-POI-A-035 Sh-1 Of 14	A

PRESSURE MEASUREMENT

(SYSTEM PR.>40Kg/Sq Cm CL 6000)



(SYSTEM PR. <40Kg/Sq cm Nb 15 CL 3000)



NOTES:–

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFIRM TO ANSI B 16.11.
2. THE LENGTH OF THE NIPPLE SHOULD BE 250mm.
3. THE OTHER END OF THE NIPPLE SHALL BE SOCKET WELDED WITH 1" GLOBE VALVE OF MATERIAL AS PER ANSI B 16.1.
4. TWO ISOLATED VALVES ARE TO BE USED FOR PRESSURE = >40 Kg/Cm2.
5. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY (1/64" RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES.
6. ORIENTATION OF TAP WILL BE VARY WITH TYPE OF PROCESS FLUID AND NATURE OF RUN OF THE PIPE.
7. ACTIVITIES TO BE COMPLETED AT THE SHOP, WELD THE COUPLING (OR BOSS) ON THE PIPE AND DRILL PRESSURE CONNECTION HOLE (SAME AS I D OF NIPPLE) IN THE PIPE IN ALLIGNMENT WITH HOLE IN THE COUPLING.
8. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.

FOR TENDER PURPOSE ONLY

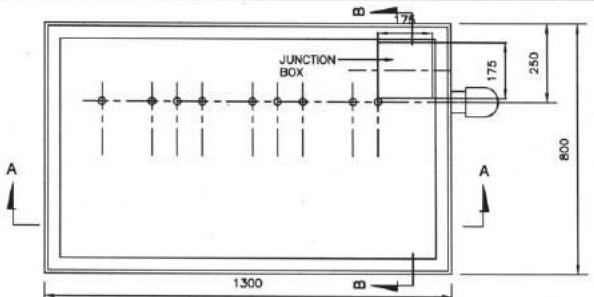
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD.	DATE
A	FIRST ISSUE							T.G.			21.06.12
					CLEARED BY						

NTPC — NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION

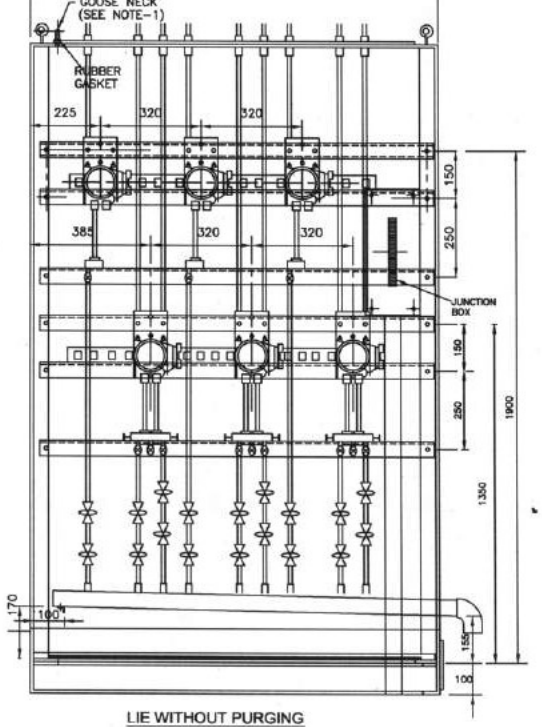
PROJECT: TYPICALTHERMAL POWER PROJECT

TITLE: INSTRUMENT SOURCE CONNECTION DETAILS

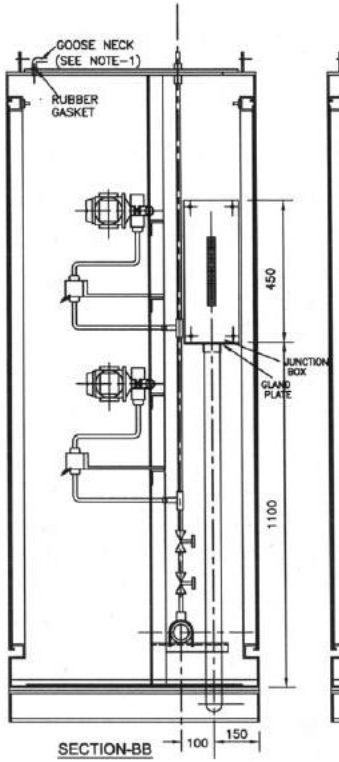
SIZE	SCALE	DRG. NO.	REV. NO.
A4	N.T.S.	0000-999-POI-A-035 Sh-2 Of 14	A



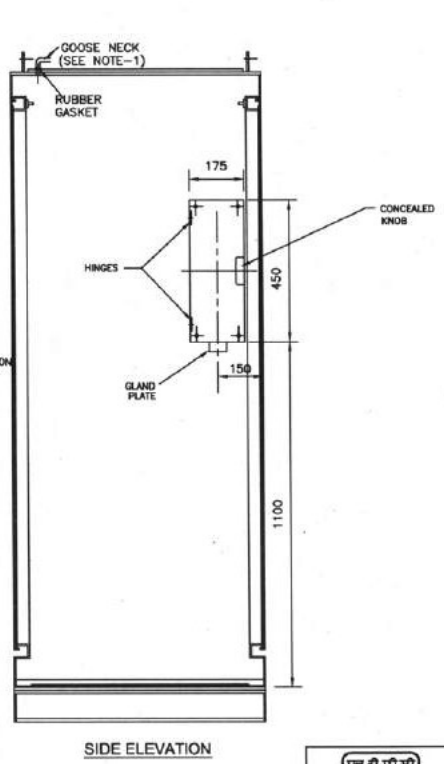
LIE TYPE	MAX. NO. OF TRANSMITTERS	DIMENSION 'X' (mm)
A	6	1250
B	4	930
C	2	630



LIE WITHOUT PURGING



SECTION-BB



SIDE ELEVATION

NOTES:-

1. TO BE PROVIDED FOR LIEs USED IN STEAM & WATER APPLICATION.
2. MATERIAL OF JBs FOR LIEs SHALL BE SAME AS THAT OF LIE.

FOR TENDER PURPOSE ONLY

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE							T.G.			21.06.12
					CLEARED BY						

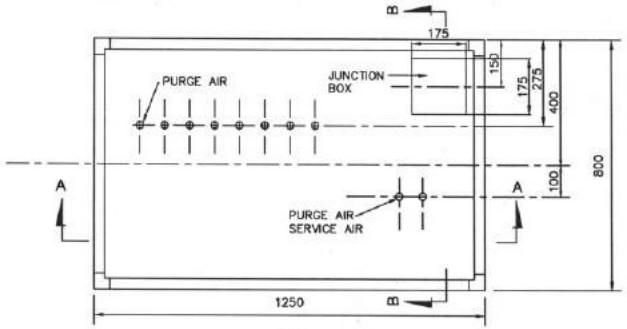
NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT

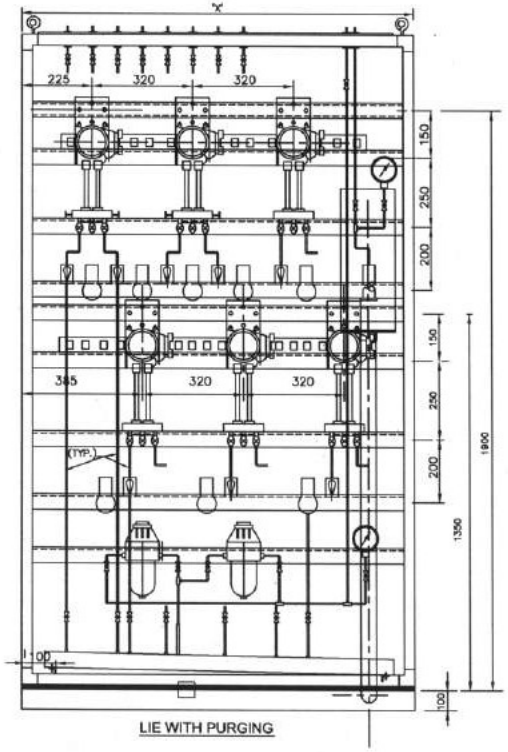
TITLE: TYPICAL GA OF LOCAL INSTRUMENT ENCLOSURE / RACK

SIZE	SCALE	DRG. NO.	REV. NO.
A2	N.T.S.	0000-999-POI-A-064	B

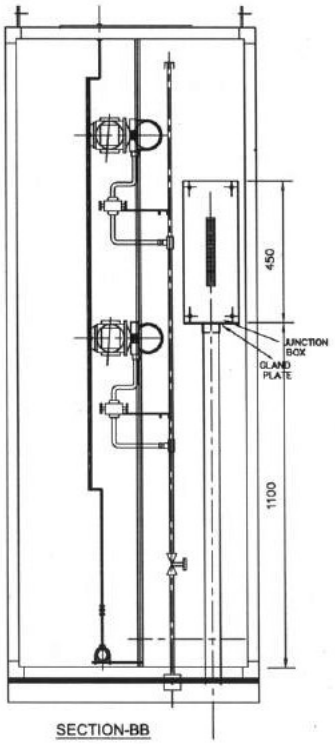
SHEET 01 OF 03



LIE TYPE	MAX. NO. OF TRANSMITTERS	DIMENSION 'X' (mm)
A	6	1300
B	4	980
C	2	680



LIE WITH PURGING



SECTION-BB

NOTES:-

1. MATERIAL OF JBs FOR LIEs SHALL BE SAME AS THAT OF LIE.

FOR TENDER PURPOSE ONLY

NTPC — NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

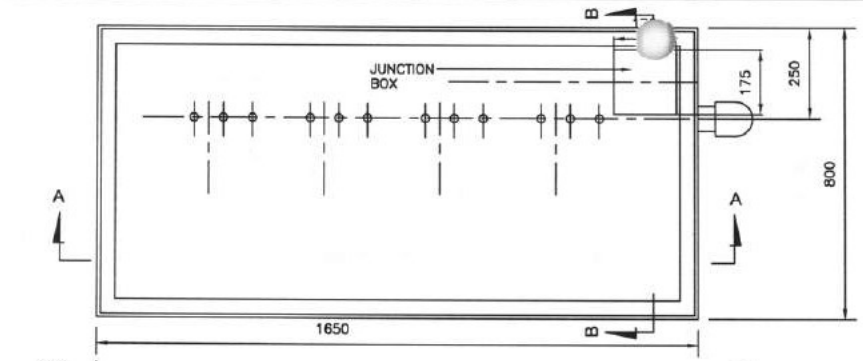
PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: TYPICAL GA OF LOCAL INSTRUMENT ENCLOSURE / RACK

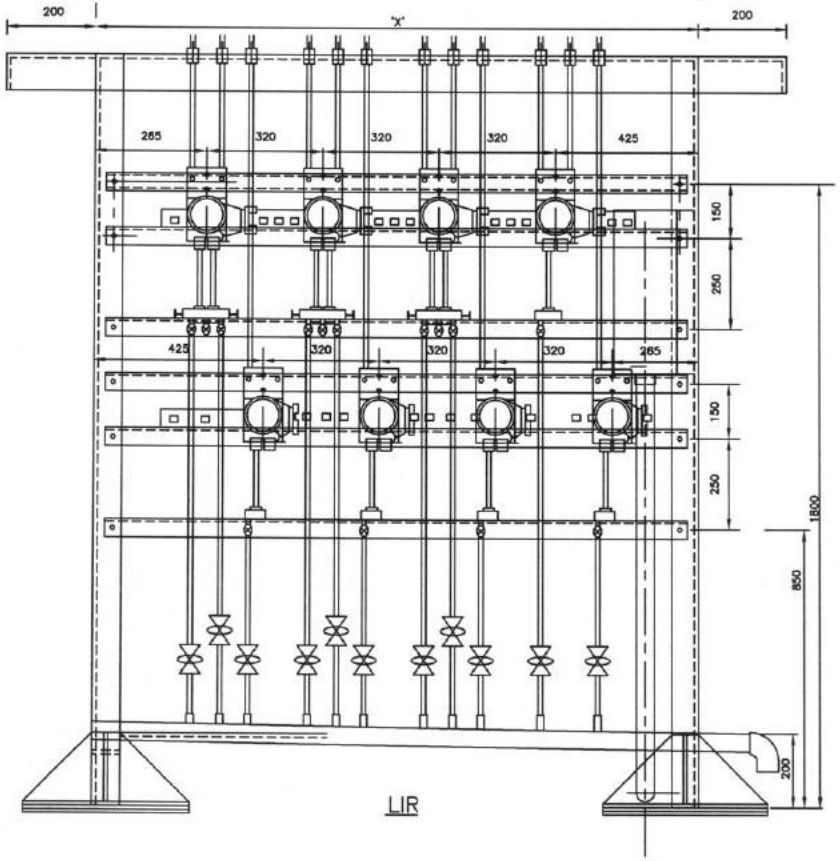
REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE							T.G.			19.04.12

CLEARED BY

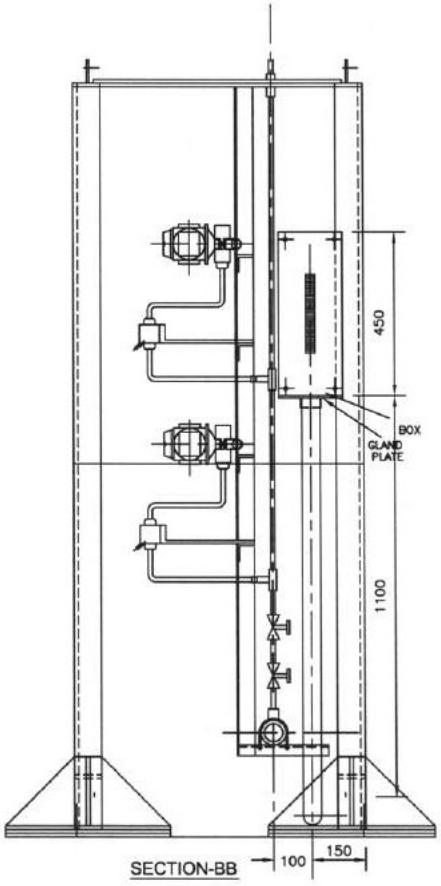
SIZE	SCALE	DRG. NO.	REV. NO.
A2	N.T.S.	0000-999-POI-A-064 SH- 02 OF 03	B



LIR TYPE	MAX. NO. OF TRANSMITTERS	DIMENSION 'X' (mm)
A	8	1650
B	6	1330
C	4	1010



LIR



SECTION-BB

NOTE:-

1. MATERIAL OF JBs FOR LIRs SHALL BE SAME AS THAT OF LIR.

SECTION-AA
LIR WITHOUT PURGING

FOR TENDER PURPOSE ONLY

NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

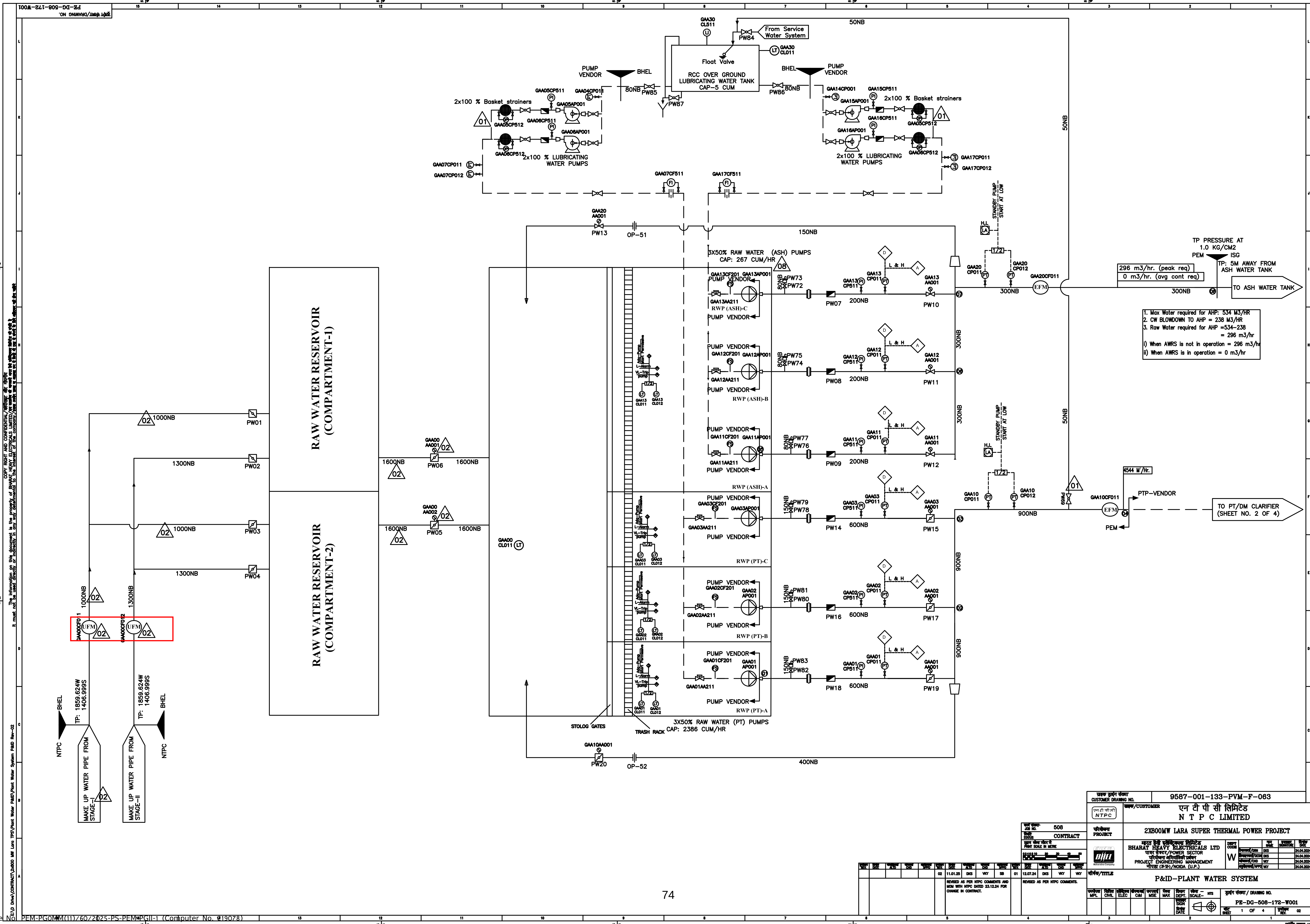
PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: TYPICAL GA OF LOCAL INSTRUMENT ENCLOSURE / RACK

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE							T.G.			21.08.12

CLEARED BY

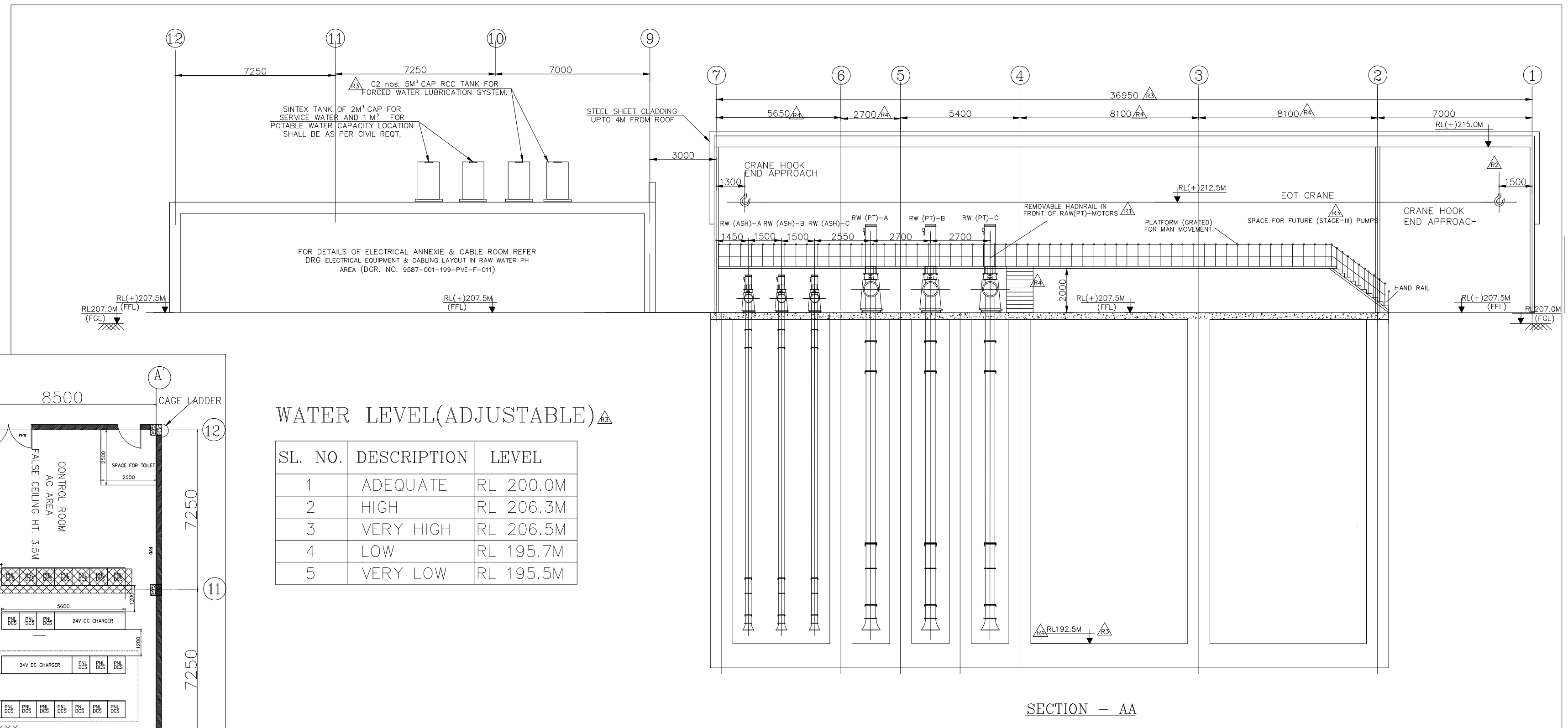
SIZE	SCALE	DRG. NO.	REV. NO.
A3	N.T.S.	0000-999-POI-A-064 SH- 03 OF 03	A



फस्ट एंगल प्रोजेक्शन/FIRST ANGLE PROJECTION
सभी माप मि मी में है/ALL DIMENSIONS ARE IN MM
PE-DG-508-172-W001
From Service Water System
PW84
Float Valve
RCC OVER GROUND LUBRICATING WATER TANK CAP-5 CUM
50NB
PUMP VENDOR
BHEL
2x100 % Basket strainers
2x100 % LUBRICATING WATER PUMPS
RAW WATER RESERVOIR (COMPARTMENT-1)
RAW WATER RESERVOIR (COMPARTMENT-2)
3X50% RAW WATER (ASH) PUMPS CAP: 267 CUM/HR
3X50% RAW WATER (PT) PUMPS CAP: 2386 CUM/HR
RWP (ASH)-C
RWP (ASH)-B
RWP (ASH)-A
RWP (PT)-C
RWP (PT)-B
RWP (PT)-A
STOLOG GATES
TRASH RACK
150NB
400NB
300NB
900NB
1000NB
1300NB
1600NB
STANDBY PUMP START AT LOW
TP PRESSURE AT 1.0 KG/CM2
PEM
ISG
296 m3/hr. (peak req)
0 m3/hr. (avg cont req)
TP: 5M AWAY FROM ASH WATER TANK
TO ASH WATER TANK
1. Max Water required for AHP: 534 M3/HR
2. CW BLOWDOWN TO AHP = 238 M3/HR
3. Raw Water required for AHP =534-238 = 296 m3/hr
i) When AWRS is not in operation = 296 m3/hr
ii) When AWRS is in operation = 0 m3/hr
4544 M³/Hr.
PTP-VENDOR
TO PT/DM CLARIFIER (SHEET NO. 2 OF 4)
TP: 1859.624W 1406.999S
MAKE UP WATER PIPE FROM STAGE-I
MAKE UP WATER PIPE FROM STAGE-II
NTPC
BHEL
ग्राहक ड्राइंग संख्या / CUSTOMER DRAWING NO. 9587-001-133-PVM-F-063
एन टी पी सी लिमिटेड
N T P C LIMITED
परियोजना / PROJECT 2X800MW LARA SUPER THERMAL POWER PROJECT
भारत हैवी इलेक्ट्रिकल्स लिमिटेड
BHARAT HEAVY ELECTRICALS LTD
पावर सेक्टर/POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
नोएडा (उ.प्र.)/NOIDA (U.P.)
शीर्षक/TITLE P&ID-PLANT WATER SYSTEM
JOB NO. 508
CONTRACT
02 11.01.25 DKS VKY REVISED AS PER NTPC COMMENTS AND MOM WITH NTPC DATED 23.12.24 FOR CHANGE IN CONTRACT.
01 12.07.24 DKS VKY REVISED AS PER NTPC COMMENTS.
PE-DG-508-172-W001
SHEET 1 OF 4
REV. 02

FIRST ANGLE PROJECTION

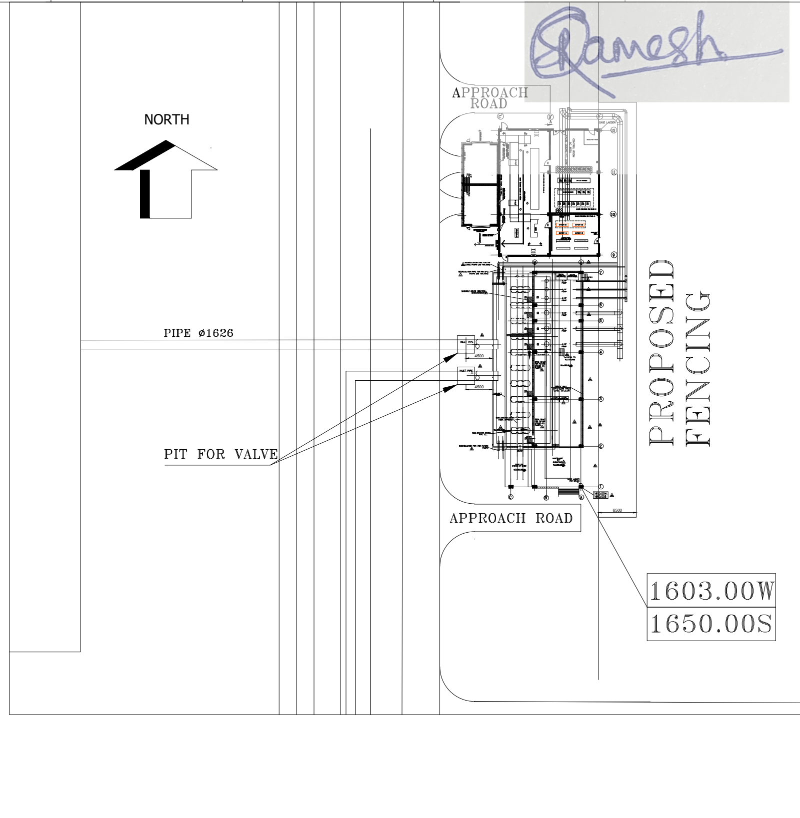
ALL DIMENSIONS ARE IN MM



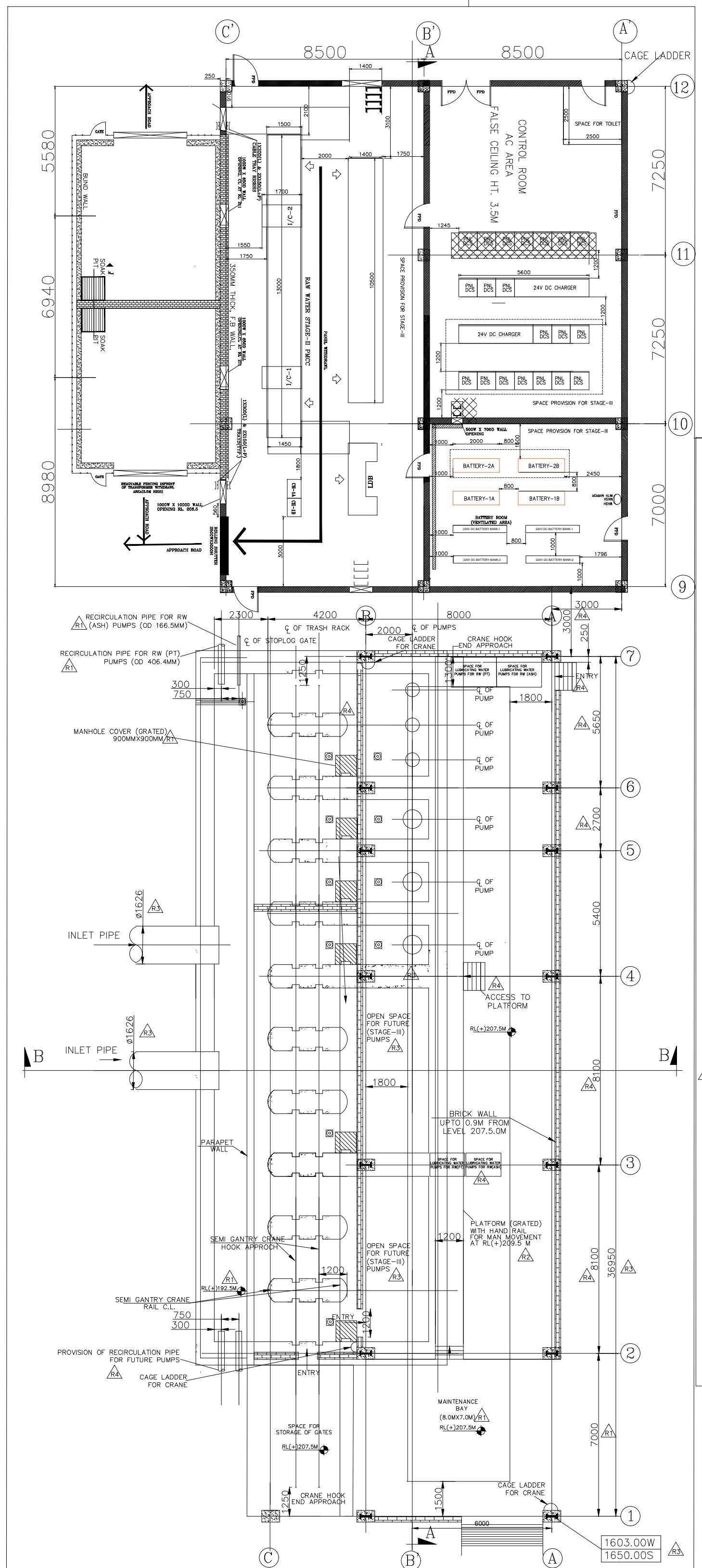
SECTION – AA

WATER LEVEL(ADJUSTABLE)

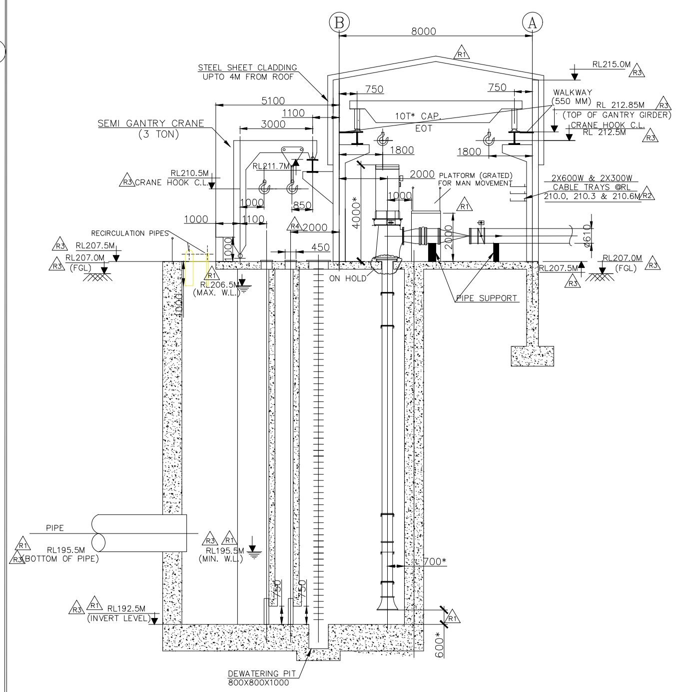
SL. NO.	DESCRIPTION	LEVEL
1	ADEQUATE	RL 200.0M
2	HIGH	RL 206.3M
3	VERY HIGH	RL 206.5M
4	LOW	RL 195.7M
5	VERY LOW	RL 195.5M



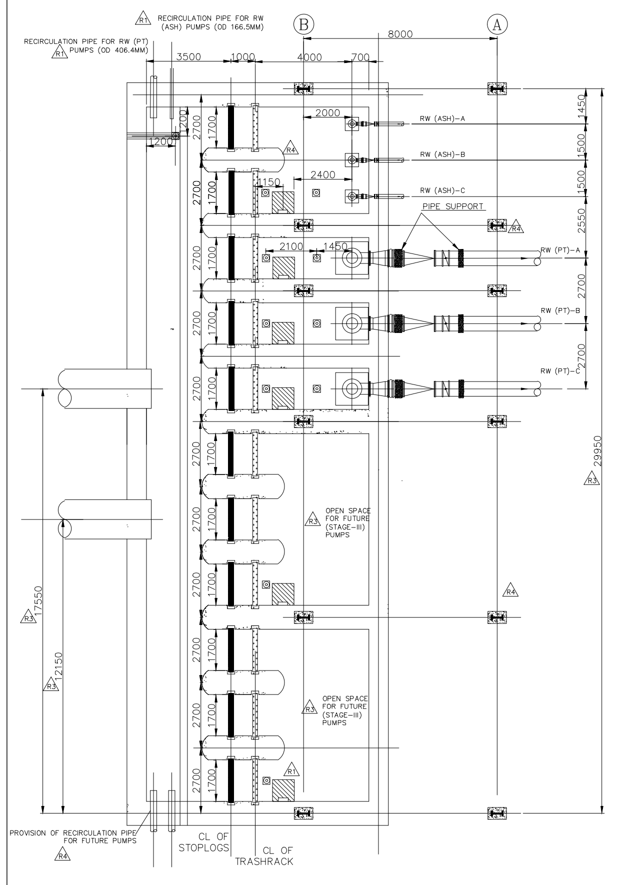
KEY PLAN (NOT TO SCALE)



PLAN OF PUMP HOUSE



SECTION – BB

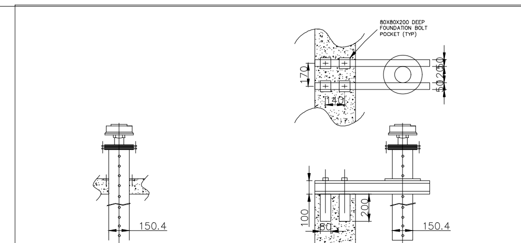


SUMP PLAN OF RAW PUMP HOUSE AT RL 207.5M

NOTES:-

1. ALL DIMENSIONS ARE IN MM AND ALL ELEVATIONS ARE IN METRES UNLESS OTHERWISE STATED.
2. CARBON STEEL GATE (TOTAL 4 NOS.) AND CARBON STEEL TRASH RACK (12 NOS. VIZ 1 NOS. FOR EACH PUMP SUMP + 1 SPARE) SHALL FABRICATED AND SUPPLIED BY BHEL-CIVIL CONTRACTOR.
3. 1 NO. EOT. CRANE OF 10 T CAP, 1 NO. SEMI GANTRY OF 3 TON CAPACITY SHALL BE PROVIDED.
4. TRASH RACK & STOP LOG GATE HEIGHT SHALL BE DESIGNED FOR SUMP OPENING HEIGHT VIZ. 750MM.
5. 1 NO. PORTABLE STOOL CUM LADDER SHALL BE PROVIDED FOR ACCESS TO TOP BEARING OF MOTOR.
6. OPENINGS INSERTS ETC. REQUIRED FOR C&I INSERTS, PIPE/VALVE SUPPORTS ETC. SHALL BE INDICATED AFTER FINALIZATION OF RESPECTIVE INSTRUMENTS PIPE LAYOUT ETC.
7. MOUNTING ACCESSORIES FOR LTS LIKE FLANGE, COUNTER FLANGES & OTHER ACCESSORIES WILL BE PROVIDED.
8. ALL FIXING DETAILS FOR RECIRCULATION PIPE SHALL BE INDICATED IN THE CIVIL DRAWING.
9. FOR FB WALL DETAILS REFER DRG "ELECTRICAL EQUIPMENT & CABLING LAYOUT IN RAW WATER PUMP HOUSE AREA (NTPC DRG NO. 9587-001-199-PVE-F-011)
10. REFERENCE DRAWINGS
   1. LAYOUT OF PIPING IN & AROUND RAW WATER PUMPS –DRG NO. PE-DG-508-100-M049
   2 ELECTRICAL EQUIPMENT & CABLING LAYOUT IN RAW WATER SWITCHGEAR ROOM (NTPC DRG NO. 9587-001-199-PVE-F-011)
   3. CIVIL ARCHITECTURAL DRAWING (DRG NO. 9587-001-136-PVC-C-0038, 9587-001-136-PVC-C-0039 & 9587-001-136-PVC-C-0042)
   4. GA & DATA SHEET OF EOT CRANE FOR RAW WATER PUMP HOUSE (NTPC DRG NO. 9587-001-102-PVM-B-089)

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



TYP DETAIL OF LEVEL TRANSMITTERS IN SUMP

2 HOLES IN FLOOR FOR LEVEL TRANSMITTERS FOR EACH SUMP

LT VIEW (NOT TO SCALE)

TYP DETAIL OF LEVEL TRANSMITTER IN FOREBAY

पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जांचकर्ता CHD	अनुमोदनकर्ता APPD	Remarks
04	09.01.25	ADK	VKY	SB	01 REVISED INLINE WITH CUSTOMER COMMENTS DATED 03.01.2025
03	27.12.24	ADK	VKY	SB	01 REVISED INLINE WITH CUSTOMER LETTER DTD 17.12.24 FOR CHANGE PROPOSAL FOR ADDITIONAL UNIT (2x800 MW).
02	06.11.24	ADK	VKY	SB	01 REVISED INLINE WITH CUSTOMER COMMENTS.
01	31.07.24	ADK	VKY	SB	01 REVISED INLINE WITH CUSTOMER COMMENTS. 02 REVISED INLINE WITH REVISED RAW WATER RESERVOIR LEVELS

ग्राहक ड्राइंग संख्या / CUSTOMER DRAWING NO.: 9587-001-133-PVM-B-071

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

कार्य संख्या- JOB NO.: 508

स्थिति STATUS: CONTRACT

मुद्रण स्केल मीटर में PRINT SCALE IN METRE

परियोजना PROJECT: 2X800MW LARA SUPER THERMAL POWER PROJECT STAGE-II

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

DEPT CODE: W

	नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
तैयारकर्ता/DRN	ADK		27.05.2024
डिजाइनकर्ता/DESN	ADK		27.05.2024
जांचकर्ता/CHD	VKY		27.05.2024
अनुमोदनकर्ता/APPD	SB		27.05.2024

शीर्षक/TITLE: MECHANICAL GA OF RAW WATER PUMP HOUSE

एमपीएल MPL	सिविल CIVIL	इलेक्ट्रिकल ELEC	सीएण्डआई C&I	एमएसई MSE	मैक्स MAX	विभाग DEPT.	स्केल – SCALE– 1:100

ड्राइंग संख्या / DRAWING NO.: PE-DG-508-172-W004

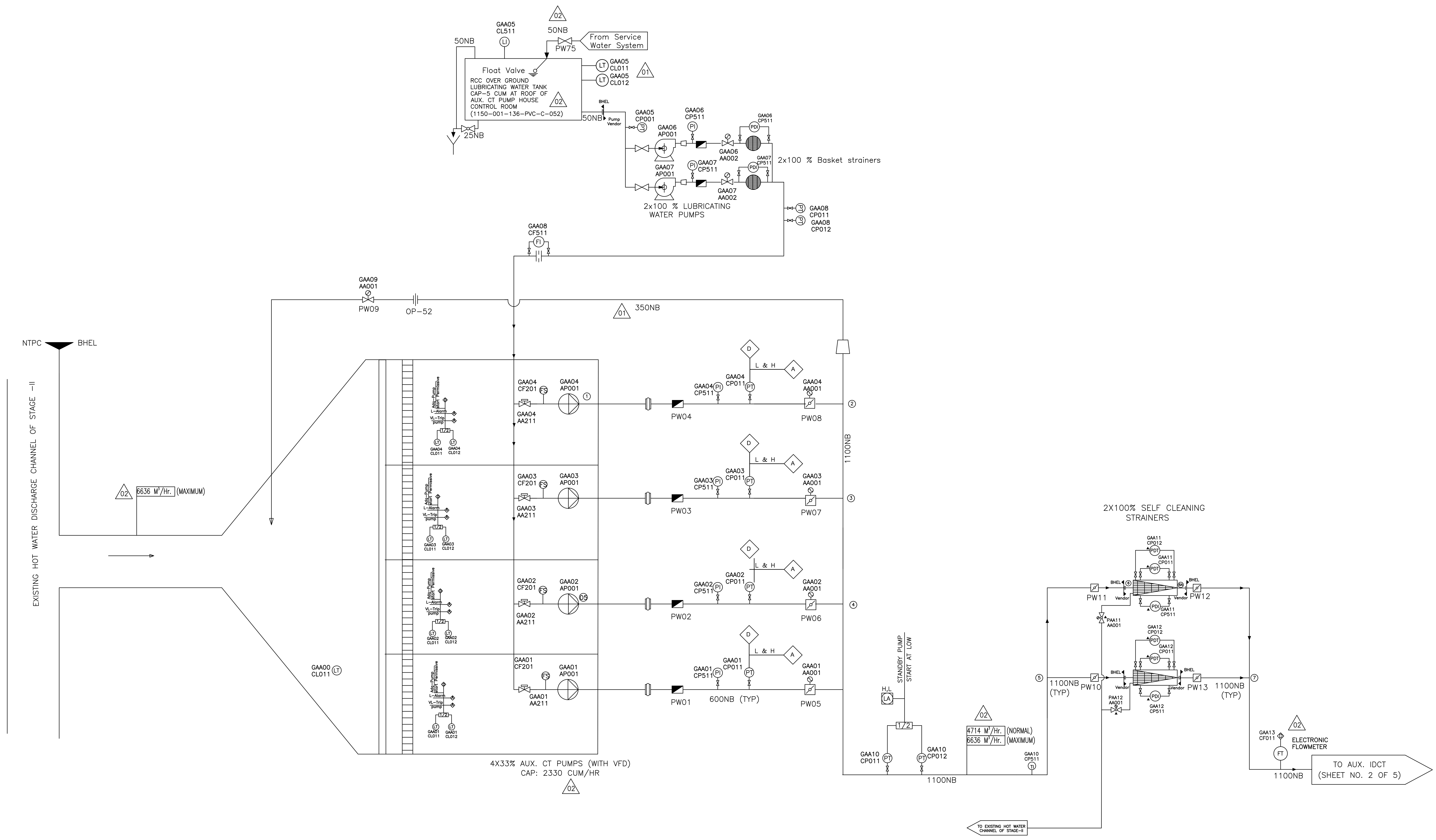
शीट SHEET 1 OF 1 — पुनरीक्षण REV. 04

फॉर्मेट साइज A0 / FORMAT SIZE A0

File No. PEM-PG0MM(11)/60/2025-PS-PEM-PGII-1 (Computer No. 219078)

फस्ट एंगल प्रोजेक्शन/FIRST ANGLE PROJECTION

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



ग्राहक ड्राइंग संख्या CUSTOMER DRAWING NO.	1150-001-136-PVM-L-002
ग्राहक/CUSTOMER	एन टी पी सी लिमिटेड N T P C LIMITED
परियोजना PROJECT	2 X 800 MW NTPC SINGRAULI STPS STAGE-III - EPC
कार्य संख्या- JOB NO.	512
स्थिति STATUS	CONTRACT
मुद्रण स्केल मीटर में PRINT SCALE IN METRE	

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

DEPT CODE: W

	नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
तैयारकर्ता/DRN	LG	Sd/-	07.10.2024
डिजाइनकर्ता/DESN	LG	Sd/-	07.10.2024
जांचकर्ता/CHD	PA	Sd/-	07.10.2024
अनुमोदनकर्ता/APPD	VKY	Sd/-	07.10.2024

पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जांचकर्ता CHD	अनुमोदनकर्ता APPD	Description
03	24.05.25	LG	PA	RN	REVISED INLINE WITH NTPC COMMENTS DATED 08.04.25
02	18.03.25	LG	PA	RN	REVISED INLINE WITH NTPC COMMENTS DATED 20.12.24 ON THIS PID AND APPROVED WATER BALANCE DIAGRAM.
01	29.11.24	LG	PA	VKY	REVISED INLINE WITH NTPC COMMENTS DATED 30.10.24

शीर्षक/TITLE: P&ID-PLANT WATER SYSTEM

एमपीएल MPL | सिविल CIVIL | इलेक्ट्रिकल ELEC | सीएण्डआई C&I | एमएसई MSE | मैक्स MAX | विभाग DEPT. | स्केल - SCALE- NTS

ड्राइंग संख्या/ DRAWING NO. PE-DG-512-172-W001

शीट SHEET 1 OF 5 — पुनरीक्षण REV. 03

फॉर्मेट साइज A0
FORMAT SIZE A0

फस्ट एंगल प्रोजेक्शन/FIRST ANGLE PROJECTION

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

ड्राइंग संख्या/DRAWING NO. PE-DG-512-172-W001

NOTES:

(02) 1.0 DESIGN PRESSURE OF AUX. CT PUMPING SYSTEM, RAW WATER (PT & ASH) PUMPING SYSTEM: 5.0 Kg/sq.cm (g)
DESIGN PRESSURE OF APH/ESP WASHING & HVAC MAKEUP PUMPING SYSTEM: 12.0 Kg/sq.cm (g)
DESIGN PRESSURE OF OTHER PUMPING SYSTEM: 10.0 Kg/sq.cm (g)

DESIGN THERMAL TEMPERATURE = 33 °C
DESIGN MECHANICAL TEMPERATURE = 60 °C

2.0 MATERIALS OF CONSTRUCTION (PIPE WORK) AS PER TECHNICAL SPECIFICATION: (01)

A) PIPING UPTO & INCLUDING 150NB SHALL BE CARBON STEEL ERW AS PER IS:1239 (HEAVY GRADE)
B) PIPING 200 NB AND ABOVE SHALL BE CARBON STEEL AS PER IS:2062 GR. E-250B ROLLED AND WELDED CONFORMING TO IS:3589

3.0 ALL PRESSURE TAPPINGS & ROOT VALVES TO BE OF 15 NB.

4.0 50 NB DRAINS & VENTS SHALL BE PROVIDED FOR PIPE SIZES 400NB & ABOVE AND 25 NB DRAINS & VENTS SHALL BE PROVIDED FOR PIPE SIZES UPTO 350NB AS PER LAYOUT REQUIREMENTS.

(02) 5.0 PAINTING/PROTECTION – PIPES:

5.1 INTERNAL SURFACE:
AS PER PAINTING SCHEME FOR LP PIPING (1150-001-102-PVM-B-001B).

5.2 EXTERNAL SURFACE – OVER GROUND PIPING & BURRIED PIPING (NOT ENCASED IN CONCRETE)
AS PER PAINTING SCHEME FOR LP PIPING (1150-001-102-PVM-B-001B)

5.3 BURRIED PIPING BELOW RAIL & ROAD:
ALL BURIED PIPES UNDER RAIL/ROAD CROSSINGS SHALL BE CONCRETE ENCASED OR CULVERT OR HUME PIPE SHALL BE PROVIDED.

Drawing/Document reference list:

1)PE-DC-512-172-W002 (PLANT WATER SYSTEM DESIGN PHILOSOPHY & SYSTEM WRITE – UP)
2)1150-001-136-PVM-Q-001 (SERVICE WATER AND POTABLE WATER DISTRIBUTION SCHEMATICS)
3)1150-001-136-PVM-F-029 (P&I DIAGRAM FOR PT PLANT)
4)1150-001-138-PVM-L-046 (P&ID FOR DM PLANT)
(02) 5)1150-001 -133-PVM-L047 (P&ID -CW & ACW SYSTEM)
6)1150-001-102-PVM-B-001B (PAINTING SCHEME FOR LP PIPING)

LEGENDS

VERTICAL CENTRIFUGAL PUMP	(LT) LEVEL TRANSMITTER
HORIZONTAL CENTRIFUGAL PUMP	(LG) LEVEL GAUGE
MOTORISED BUTTERFLY VALVE	(PT) PRESSURE TRANSMITTER
MANUAL BUTTERFLY VALVE	(PI) PRESSURE GAUGE
MOTORISED GLOBE VALVE	(FT) FLOW TRANSMITTER (ORIFICE TYPE)
MANUAL GLOBE VALVE	(FT) ELECTRONIC FLOWMETER
MOTORIZED GATE VALVE	(FI) FLOW INDICATOR (ORIFICE TYPE)
MANUAL GATE VALVE	(FS) FLOW SWITCH
NON-RETURN VALVE	SOLENOID OPERATED VALVE
	ORIFICE PLATE
	GATE VALVE WITH LIMIT SWITCH
	BUTTERFLY VALVE WITH LIMIT SWITCH
	(UFT) FLOW TRANSMITTER (ULTRASONIC TYPE) (01)

(02)

PIPE SIZES OF CS PIPING

NB	OD	THICK.
25	34.2	4.0
40	48.8	4.0
50	60.8	4.5
80	89.5	4.8
100	115.0	5.4
150	166.5	5.4

NB	OD	THICK.
200	219.1	6.0
250	273.0	6.0
300	323.9	6.0
350	355.6	6.0
400	406.4	6.0
450	457.0	6.0
500	508.0	6.0
600	610.0	6.0
700	711.0	7.0
800	813.0	8.0
900	914.0	10.0
1100	1118.0	10.0
1200	1219.0	12.0

D:\D Data\Drive 1\LOKESH WORK\Lokesh BHEL Office\WSE\Singrauli Contract\Work\P&IDs\PLANT WATER\R03\PE-DG-512-172-W001 R02

पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जांचकर्ता CHD	अनुमोदनकर्ता APPD	Description
03	24.05.25	LG	PA	RN	REVISED INLINE WITH NTPC COMMENTS DATED 08.04.25
02	18.03.25	LG	PA	RN	REVISED INLINE WITH NTPC COMMENTS DATED 20.12.24 ON THIS PID AND APPROVED WATER BALANCE DIAGRAM.
01	29.11.24	LG	PA	VKY	REVISED INLINE WITH NTPC COMMENTS DATED 30.10.24

कार्य संख्या- JOB NO. 512
स्थिति STATUS CONTRACT
मुद्रण स्केल मीटर में PRINT SCALE IN METRE

ग्राहक ड्राइंग संख्या CUSTOMER DRAWING NO. 1150-001-136-PVM-L-002

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

परियोजना PROJECT 2 X 800 MW NTPC SINGRAULI STPS STAGE-III – EPC

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

DEPT CODE W

	नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
तैयारकर्ता/DRN	LG	Sd/-	07.10.2024
डिजाइनकर्ता/DESN	LG	Sd/-	07.10.2024
जांचकर्ता/CHD	PA	Sd/-	07.10.2024
अनुमोदनकर्ता/APPD	VKY	Sd/-	07.10.2024

शीर्षक/TITLE P&ID-PLANT WATER SYSTEM

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

स्केल – SCALE– NTS

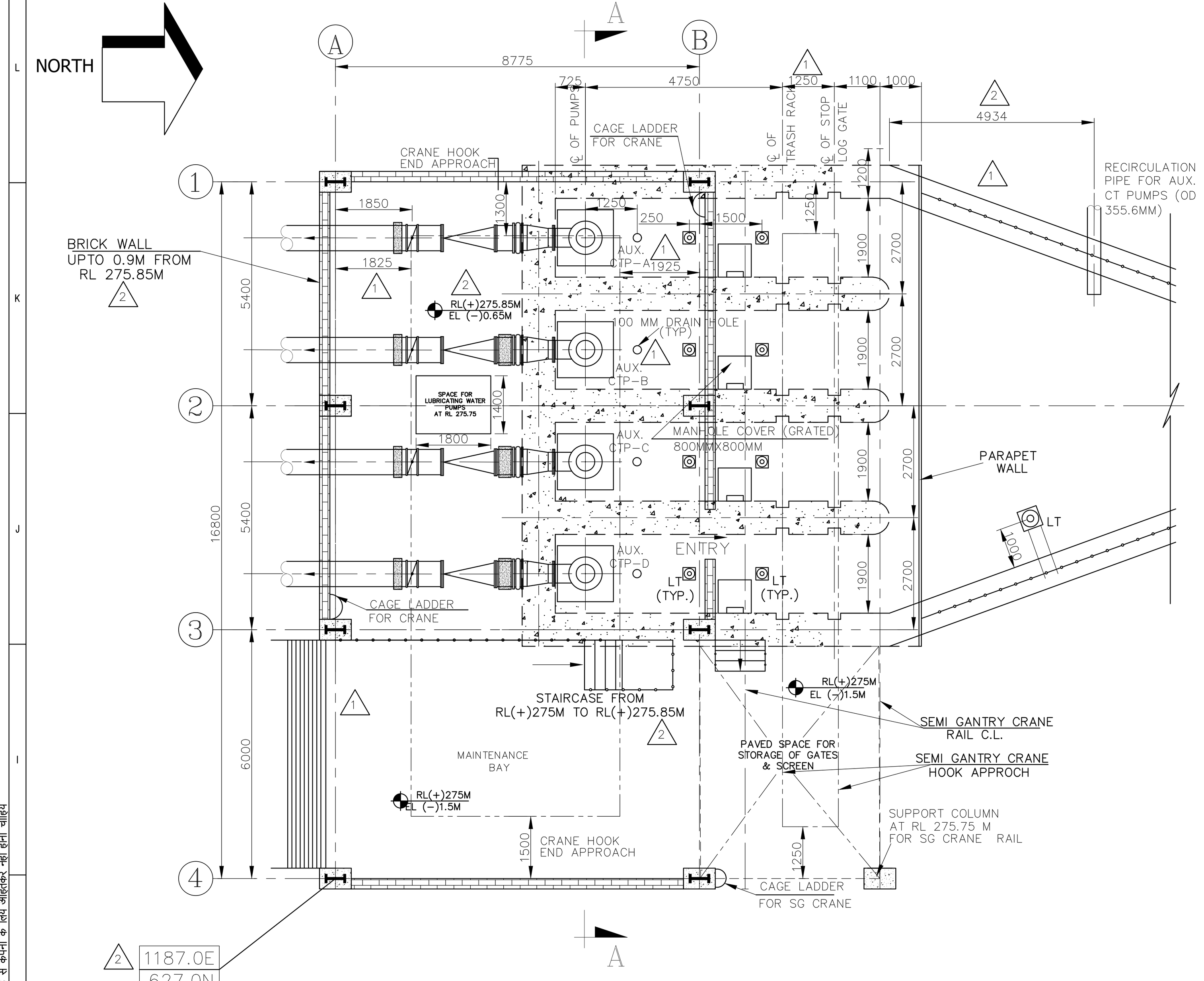
ड्राइंग संख्या/ DRAWING NO. PE-DG-512-172-W001

शीट SHEET 5 OF 5 पुनरीक्षण REV. 03

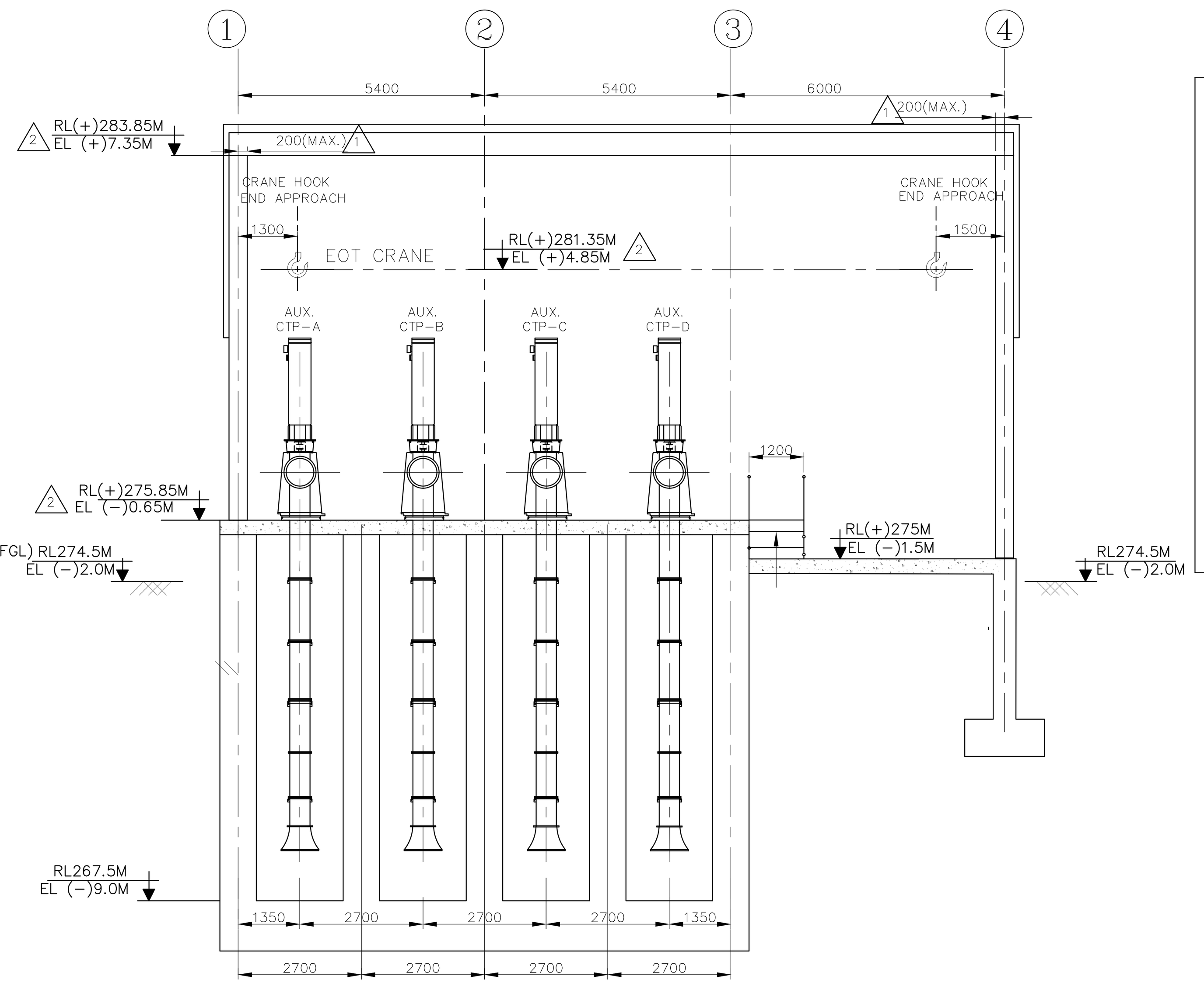
फॉर्मेट साइज A0 FORMAT SIZE A0

फस्ट एंगल प्रोजेक्शन/FIRST ANGLE PROJECTION

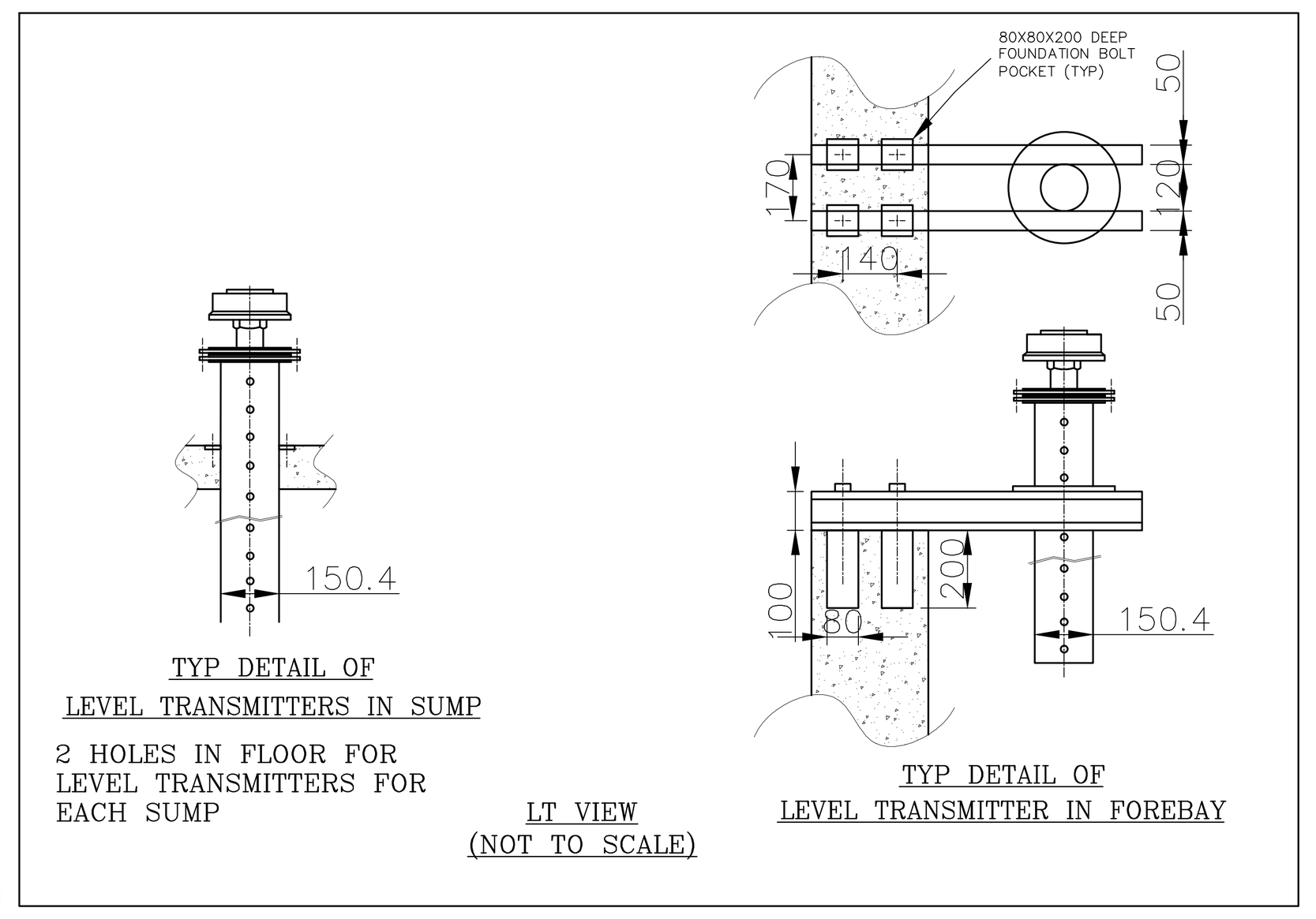
सभी माप मि॰ मी॰ मे है/ALL DIMENSIONS ARE IN MM

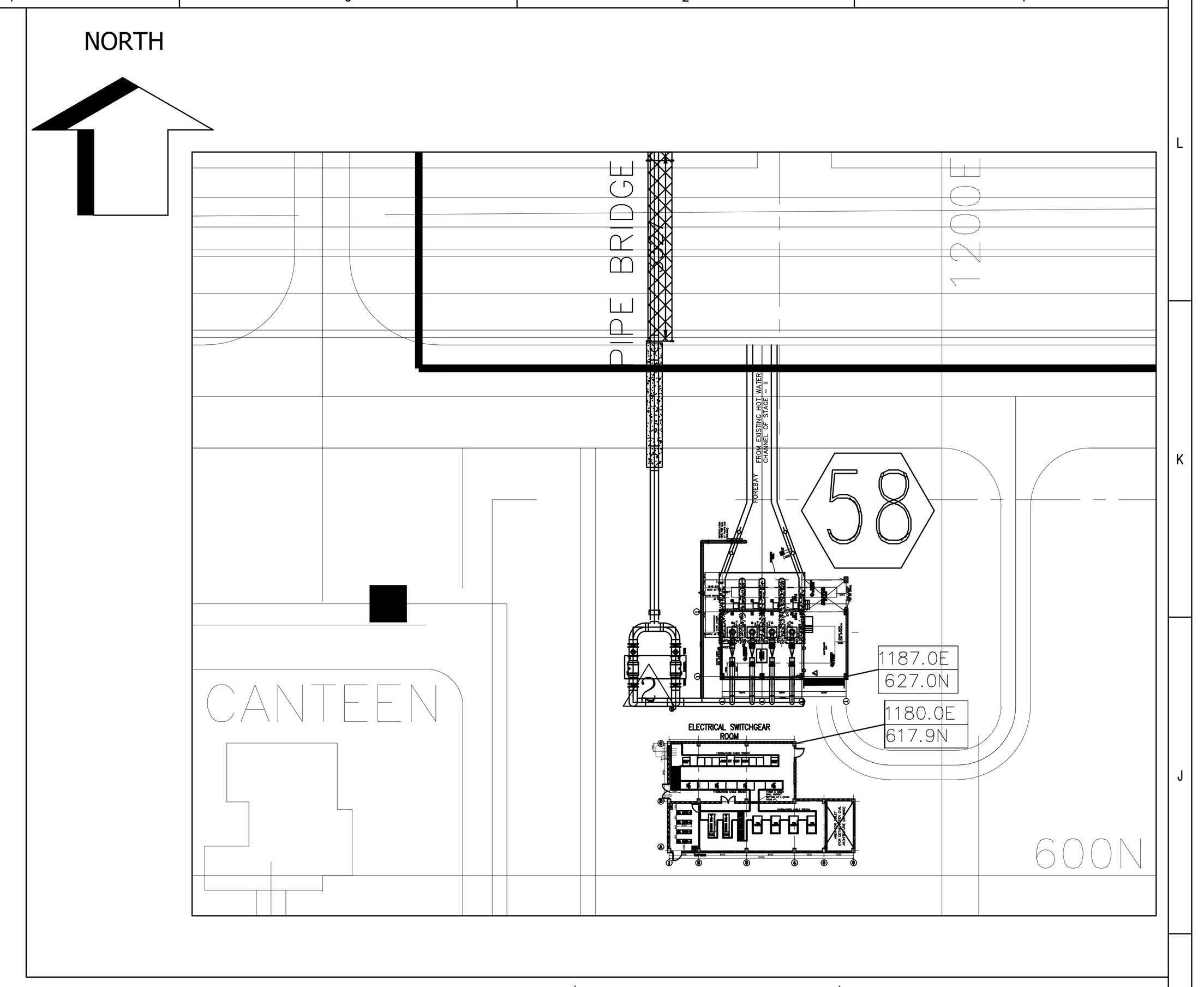


PLAN OF PUMP HOUSE AT RL 275.85

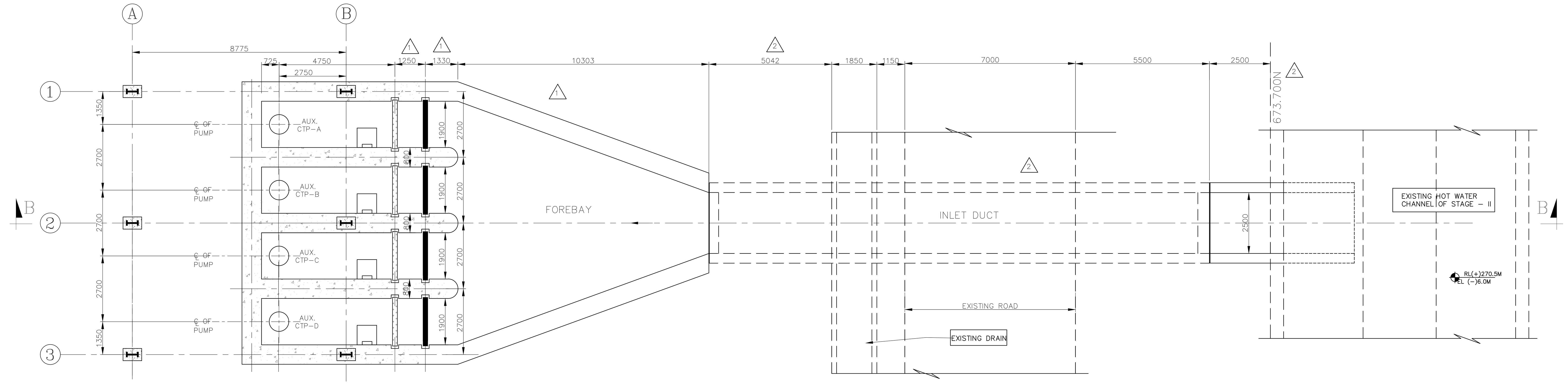


SECTION - AA

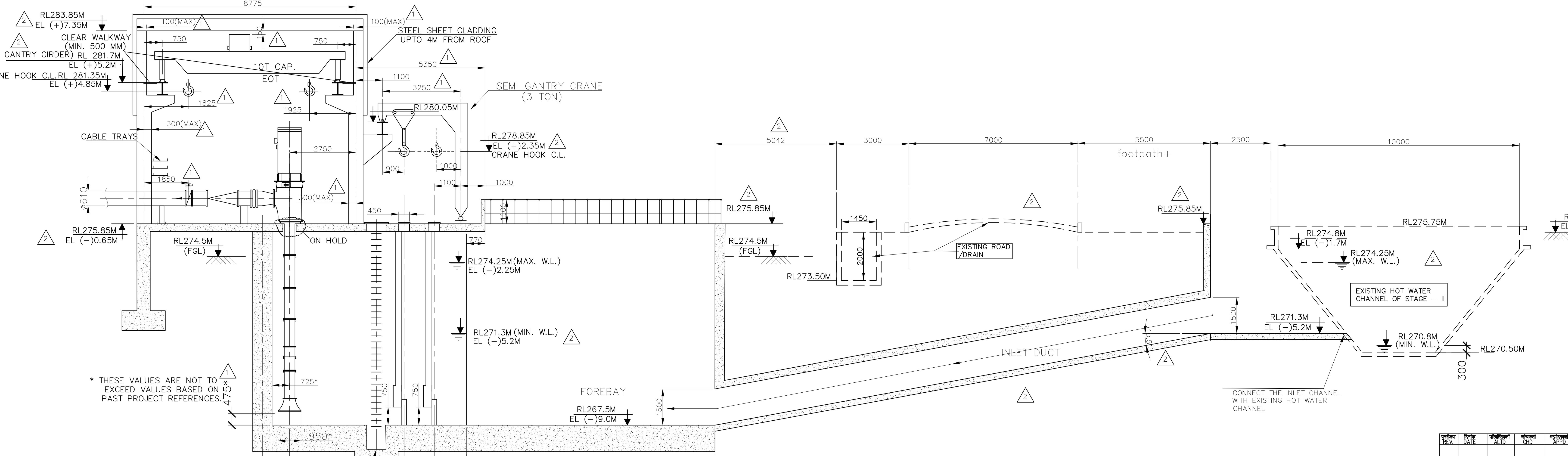




KEY PLAN (NOT TO SCALE)



SUMP PLAN OF AUX. CT PUMP HOUSE



SECTION - BB

NOTES:-

1. ALL DIMENSIONS ARE IN MM AND ALL ELEVATIONS ARE IN METRES UNLESS OTHERWISE STATED.
2. ALL ELEVATION ARE REFERRED TO POWER HOUSE GROUND FLOOR EL(+) 0.00M, WHICH CORRESPOIND TO RL 276.5M ABOVE MSL.
3. STOP LOG GATES: TOTAL QUANTITY 2 NOS. MATERIAL OF CONSTRUCTION, PAINTING & OTHER DETAILS AS PER CL. NO. 5.18.01.08.06 OF SUB-SECTION D-1-5 OF PART-B, SEC-VI OF NTPC SPECIFICATION.
4. COARSE SCREEN: TOTAL QUANTITY 5 NOS (INCLUDING 1 NOS SPARE SCREEN). MATERIAL OF CONSTRUCTION, PAINTING & OTHER DETAILS AS PER CL. NO. 5.18.01.08.06 OF SUB-SECTION D-1-5 OF PART-B, SEC-VI OF NTPC SPECIFICATION. CENTRE TO CENTRE SPACING OF TRASH RACK BARS SHALL BE 100MM (MAX).
5. 1 NO. EOT. CRANE OF 10 T CAP, 1 NO. SEMI GANTRY OF 3 TON CAPACITY SHALL BE PROVIDED.
6. TRASH RACK & STOP LOG GATE HEIGHT SHALL BE DESIGNED FOR SUMP OPENING HEIGHT VIZ. 750MM.
7. 1 NO. PORTABLE STOOL CUM LADDER SHALL BE PROVIDED FOR ACCESS TO TOP BEARING OF MOTOR.
8. OPENINGS INSERTS ETC. REQUIRED FOR C&I INSERTS, PIPE/VALVE SUPPORTS ETC. SHALL BE INDICATED AFTER FINALIZATION OF RESPECTIVE INSTRUMENTS PIPE LAYOUT ETC.
9. 5 CUB M RCC TANK FOR FORCED WATER LUBRICATION SYSTEM TO BE PROVIDED ON ROOF OF CONTROL ROOM BUILDING BY CIVIL CONTRACTOR.
10. REFERENCE DRAWINGS
   (a) RAW WATER PH & ASSOCIATED PIPING LAYOUT (Doc. No. 1150-001-136-PVM-B-071A)
   (b) GENERAL ARRANGEMENT AND CROSS SECTIONAL-PUMPS (1150-001-110-PVM-B-087)
   (c) GA OF SINGLE GIRDER CRANE WITH CT DSL ARRANGEMENT(1150-001-136-PVM-B-043A)

पुनरीक्षण REV.	दिनांक DATE	परिवर्तितकर्ता ALTD	जांचकर्ता CHD	अनुमोदनकर्ता APPD
02	12.08.25	LG	PA	RN
01	04.03.25	LG	PA	VKY

01 REVISED INLINE WITH NTPC COMMENTS DATED 22.03.25

02 COORDINATES & INTAKE CHANNEL REVISED AS PER SITE FEEDBACK.

01 REVISED INLINE WITH NTPC COMMENTS DATED 19.02.25

ग्राहक ड्राइंग संख्या CUSTOMER DRAWING NO.	1150-001-136-PVM-B-071
ग्राहक/CUSTOMER	एन टी पी सी लिमिटेड N T P C LIMITED
कार्य संख्या- JOB NO.	512
स्थिति STATUS	CONTRACT
मुद्रण स्केल मीटर में PRINT SCALE IN METRE	0 2 4 6 8 10 20 30 40 50
परियोजना PROJECT	2X800MW NTPC SINGRAULI STPS STAGE-III - EPC

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

DEPT CODE: W

	नाम NAME	हस्ताक्षर SIGNATURE	दिनांक DATE
तैयारकर्ता/DRN	DK		31.01.2025
डिजाइनकर्ता/DESN	LG		31.01.2025
जांचकर्ता/CHD	PA		31.01.2025
अनुमोदनकर्ता/APPD	VKY		31.01.2025

शीर्षक/TITLE: MECHANICAL GA OF AUX. CT PUMP HOUSE

एमपीएल MPL	सिविल CIVIL	इलेक्ट्रिकल ELEC	एसएण्डसीई S&CE	WSE	मैक्स MAX	विभाग DEPT.
						हस्ताक्षर SIGN
						दिनांक DATE

स्केल - SCALE- 1:100

ड्राइंग संख्या / DRAWING NO. PE-DG-512-172-W004

शीट SHEET 1 OF 1 पुनरीक्षण REV. 2

फॉर्मेट साइज A0
FORMAT SIZE A0

PERFORMANCE GUARANTEES TO BE DEMOSTRATED AT SHOP & SITE

ANNEXURE FOR PERFORMANCE GUARANTEE AND TESTING

A. GENERAL

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

B. PG Testing at Shop

1 Capacity, head, and power consumption of all the pumps at the rated duty point (to be demonstrated and proved at shop with the respective job motors) and to operate in accordance with the approved pump characteristic curves. During the shop test no negative tolerance in the guaranteed capacity, head and efficiency of the pump shall be allowed. Applicabilty of Test for each type of Pump shall be as per TECHNICAL DATA - PART - A.

2 The efficiencies for pumps and motors for arriving at benchmark power consumption for Bid Evaluation shall be as indicated in TECHNICAL DATA - PART - A for various pumps.
No advantage shall be given to the bidder for quoting Power consumption (kW) at motor inlet lower than the benchmark kW value calculated with benchmark efficiencies given in Datasheet. However, in such case, quoted power consumption (kW) at motor inlet by the bidder shall be replaced with Benchmark Power consumption for both evaluation as well as LD purposes.

3 For the purpose of Bid Evaluation, Efficiencies for HT motors and LT motors which are not in bidder's scope shall be taken based on the maximum value as furnished in TECHNICAL DATA - PART - A.
During contract stage, for Pumps driven by BHEL supplied drives (HT/LT), Revised guarantee power consumption shall be calculated with motor efficiency (M) as per approved datasheet of the supplied HT/LT motor. All other parameters shall remain same.

4 The bid evaluation applicable at the rate as specified below to be calculated per working pump (and not standby) as follows:

Power consumption at inlet to the motors:

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

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

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

C. PG Testing at Site

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

2 After commissioning of pumps at site, performance test shall be conducted by pump vendor at project site to ensure that the pumps meet the specified requirements. PG Test shall be conducted as per approved PG Test Procedure. Applicabilty of Performance Test for each type of Pump shall be as per TECHNICAL DATA - PART - A.

3 Vendor to replace / take corrective action for any deficiency in performance parameters at site. 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 price implication.

4 All instruments required for PG testing of Noise, vibration and parallel running of pumps are to be provided by Bidder and taken back after the Test. All instruments used for PG Test shall be duly calibrated.

	TECHNICAL SPECIFICATION MISC. PUMPS (VERTICAL) 2X800 MW LARA STAGE-II & 2X800 SINGRAULI STAGE-III	PE-TS-508/512-100-W002 Rev. No. 00 Date : 14.08.25
	SCHEDULE OF PERFORMANCE GUARANTEES	

Following parameters are guaranteed for following pumps

2x800 MW NTPC LARA STAGE-II

Sl. No.	Pump Description	Guaranteed Capacity	Guaranteed TDH	Guaranteed Pump Eff.	Guaranteed Motor Eff.	Guaranteed Power consumption at inlet to motor terminals	Motor Rating	Motor GD^2 Value for HT motor only	Pump RPM	T/S Curve attached for HT motor
		(M3/Hr)	(MWC)	%	%	(KW)	(KW)			
	Vertical pumps									
1	# Raw Water (PT) Pumps	2400	42		95					
2	# Raw Water (Ash) Pumps	275	60					NA		NA

Bid evaluation and LD is applicable for pumps marked with (#) only as per TECHNICAL DATA - PART - A (2X800MW LARA).

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 BHEL as per specification.

PARTICULARS OF BIDDER/ AUTHORISED REPRESENTATIVE

NAME DESIGNATION SIGNATURE DATE COMPANY SEAL

	TECHNICAL SPECIFICATION MISC. PUMPS (VERTICAL) 2X800 MW LARA STAGE-II & 2X800 SINGRAULI STAGE-III	PE-TS-508/512-100-W002 Rev. No. 00
	SCHEDULE OF PERFORMANCE GUARANTEES	Date : 14.08.25

Following parameters are guaranteed for following pumps

2x800 MW NTPC SINGRAULI STAGE-III

Sl. No.	Pump Description	Guaranteed Capacity	Guaranteed TDH	Guaranteed Pump Eff.	Guaranteed Motor Eff.	Guaranteed Power consumption at inlet to motor terminals	Motor Rating	Motor GD^2 Value for HT motor only	Pump RPM	T/S Curve attached for HT motor
		(M3/Hr)	(MWC)	%	%	(KW)	(KW)			
	Vertical pumps									
1	# AUX. CT PUMPS	2330	25		95					YES

Bid evaluation and LD is applicable for pumps marked with (#) only as per TECHNICAL DATA - PART - A (2X800 MW SINGRAULI).

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 BHEL as per specification.

PARTICULARS OF BIDDER/ AUTHORISED REPRESENTATIVE

NAME DESIGNATION SIGNATURE DATE COMPANY SEAL

STANDARD TEST PROCEDURE PERFORMANCE GUARANTEE FOR MISCELLANEOUS PUMPS

APPLICABLE FOR 2X800 MW LARA STAGE-II & 2X800 SINGRAULI STAGE-III

Station: ……

CONTENTS

PG TEST PROCEDURE FOR MISCELLANEOUS PUMPS

_____ EQUIPMENT PACKAGE FOR____STATION, STAGE-_ _

NTPC Drg. No.: _____Vendor Drg. No.: _____Date: –

1. OBJECT OF P.G. TEST:

Site test of Miscellaneous (SACW/RW (PT & ASH)/ ECW/DMCW/ ACW) Pumping equipment will be conducted to establish the performance under actual installed conditions with the Pumps as part of the system and when operating against the system resistance.

2. SCOPE:

P.G. Test applicable to Miscellaneous (SACW/RW (PT & ASH)/ ECW/DMCW/ ACW) Pumping equipment is as follows:

2.1. Verification of all Interlocks & Protection relating to the Pump & Motor.
2.2. Proper running of Pumps on load will be verified and Temperature of Bearings will be checked.
2.3. Verification of Pump & Motor Bearing Vibration and measurement of Noise Level.
2.4. Verification of satisfactory parallel operation of Pump.
2.5 Verification of satisfactory operation of Discharge Butter Fly Valve.

3. GENERAL CONDITIONS:

3.1. The Pump shall be in good operating condition at the time of test.
3.2. Water level shall be maintained as per requirement of the Pump during the test.
3.1. Approved Data Sheet of the Pumps, Shop test results witnessed by NTPC & Performance Curve based on Shop Test result shall be presented to NTPC – _ Site before conductance of PG Test.

4. CALIBRATION OF INSTRUMENTS:

All Instruments required for the Test, except Current Transformers, will be arranged by vendor. Calibration of Instruments, to be supplied by vendor for the Tests shall be the responsibility of vendor. Any one of the following independent agencies shall carry out calibration of these Instruments:

4.1. Electronic Research & Testing Laboratory – Kolkata.
4.2. Any other Government Institute / NTPC approved Laboratory.
4.3 Copies of the valid Calibration Certificates of all instruments shall be sent to NTPC – _Station . Site at least 15 days before conductance of PG Test for approval.

5. GUARANTEED VALUES TO BE PROVED / DEMONSTRATED (Values to be filled up as per attachment 10):

5.1. Guaranteed Design Capacity: (M3/Hr.): Shop Test only
5.2. Guaranteed Total Head: (MWC) : Shop Test only
5.3. Total Bowl Head at guaranteed Design capacity: Shop Test only
5.4. Rated Speed (RPM) : Shop Test & Demo at site

5.5. Guaranteed Power consumption at Motor Terminals at Duty point (KW): Shop Test only
5.6. Maxm. Power Consumption at Motor Terminals in the Pump operating range (KW): Shop Test only
5.7. Vibration Level (Velocity in mm / sec) : Site Test
5.8. Noise Level (d BA) : Site Test
5.9. Parallel Operation (Site Test) : For equal load sharing Input Power to Motors should be within _ _%.

5.10. Bearing Temperature (°C) (Site Test) : ___ Deg. C (maximum)

NOTE:

Total Head = Pressure at Centre line of Pump Discharge Flange + Velocity Head at Discharge Flange + Level difference between minimum water level to Centre line of the Pressure Gauge at Pump Discharge Flange.

OTHER PARAMETERS TO BE MEASURED (MAY NOT BE GUARANTEED)

a) Current in Amps.
b) Voltage in Volts
c) Frequency in Cycles / Sec.
d) Sump Level

6. METHOD OF PERFORMANCE TESTING OF (/RW(PT & ASH)/ ECW/DMCW/ ACW) PUMPS:

6.1. Speed will be measured with the help of a calibrated non-contact type Digital Tachometer.
6.2. Power input (P) will be measured with the help of two calibrated Wattmeters and suitable Current Transformers & Voltage Input at MCC of the client will be used for this purpose.
6.3. Correction Factor Rated Speed of the Pump

$$\text{Speed Ratio} = \frac{\text{Rated Speed of the Pump}}{\text{Test Speed of the Pump}} = C$$

Corrected discharge head at rated speed = $C^2 \times H$

Corrected Power Input at rated speed = $C^3 \times P$

Discharge of the Pump (Q) will be found out from the H/Q Curve obtained during Performance Testing of the Pump at Test Laboratory of VENDOR Works.

6.4. Acceptance Criteria: Vibration & Noise level should be within specified limits.

7. FUNCTIONAL GUARANTEE TEST:

7.1. Noise Level Check: Noise measurement will be done all around Pump & Motor Set at a distance of 1.0 Metre from the nearest surface of the Pump – Motor Set at a height of 1.0 Metre from the floor level, as per HIS by a Noise Level Meter. The maximum level of Noise should be _____ dBA.

7.2. Vibration check: Vibration will be checked at all Bearing locations (NDE & DE Sides of Motor

& NDE & DE Sides Pump Bearing) as per HIS / IS with the help of Vibrometer in Horizontal, Vertical and Axial directions. The acceptable limit is _ _ mm / sec (velocity) or __ microns (displacement).

7.3. Parallel Operation Check: Parallel operation check will be carried out by operating two Pumps in parallel. At equal heads / discharge pressure, equal load sharing of the pumps connected in parallelshall be measured by checking power input at Motor Terminals. The Power Values should be within _ %. There should not be any abnormal noise / vibration during parallel operation.

7.4. Bearing Temperature: All Pump and Motor Bearing Temperature will be recorded at 15 minutes interval, during two hours duration of test & the maximum temperature recorded should not be more than Degree Centigrade. A hand held Thermometer should be used for this purpose.

8. DURATION OF TEST:

Test should be conducted for duration of 2 hours.

9. LIST OF INSTRUMENTS FOR SITE TEST:

SL. NO.	INSTRUMENT	TYPE	ACCURACY	REMARKS
1	Wattmeter	Industrial / Laboratory	+ 0.5%	
2.	Pressure Gauge	Bourdon type	+ 0.5%	
3.	Vibrometer	IRD 308 or equivalent	+ 3%	
4	Noise Level meter	Sound level	+ 2 d BA	
5	Digital Tachometer	Electrical non-contact type	+ 1 RPM	
6.	Digital Thermometer		+ 0.1 Deg C	
7.	Stop Watch		+ 0.5 %	

10. PROFORMA FOR READINGS OF PG TEST:

10.1. Pumps running in parallel (Frequency of reading – 15 minutes)

SL. NO.	PUMP NO.			PUMP NO.		
	Disch. Pr.	Wattmeter	Reading	Disch. Pr.	Wattmeter	Reading
	(Kg / Cm2)	W-1	W -2	(Kg / Cm2)	W -3	W -4
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						

10.2. Vibration Readings:

____PUMP #	VELOCITY IN MM / SEC		
	Horizontal	Vertical	Radial
Motor NDE Side			
Motor DE Side			
Pump NDE Side			
Pump DE Side			

10.3. Readings of Individual Pump during test (frequency of readings – 15 minutes)

(MuW/RW (PT & ASH)/ ECW/DMCW/ ACW) PUMP #

SL. NO.	Difference of height between Water level & Pr. Gauge (Meters)	Discharge Pressure (Kg / Cm2)	Speed (RPM)	Wattmeter Reading (W-1)	Wattmeter Reading (W-2)
.					
.					
.					
.					
.					
.					
.					
.					

CT Ratio ----------, Wattmeter (W-1) Constant ----, Wattmeter (W-2) Constant ------

10.4. Noise Level of_____Pump – Motor Set (in d BA):

PUMP #

HORIZONTAL PLANT						VERTICAL PLANTE					
E-1	E-2	E-3	E-4	E-5	E-6	V-1	V-2	V-3	V-4	V-5	V-6

10.5. Bearing Temperature, in Deg. C (Frequency 15 Minutes):

PUMP #

SL. NO.	Motor DE in Deg C	Motor NDE in Deg C	Pump DE in Deg C	Pump NDE in Deg C
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				

11. METHOD OF PERFORMANCE TESTING OF BUTTERFLY VALVE:

Test of Butterfly valve should be carried out in the following manner:

11.1. Valve will be given an "OPEN" Command. It should open from fully closed position to fully open position without any problem. The Valve should stop automatically after it reaches Full Open (100 % open) position.

11.2. The Valve will then be issued a "CLOSE" Command. It should reach fully closed condition from fully open condition without any problem. It should stop automatically once it reaches fully closed position (100% closed).

11.3. The time taken for Opening & Closing of Butter Fly Valves should be as per approved Data Sheet.

PROFORMA FOR RECORDING OF PG TEST FOR Butter Fly Valve (BFV)

BFV FOR_____PUMP #	TIME IN SECONDS
From 100% closed to 100% open position	
From 100% open to 100% closed position	

Note:
1. Vendor to sign /digitally sign and stamp on all pages of PG procedure.
2. Attachment 10 giving guaranteed parameters to be enclosed.
3. Relevant pages of Functional Guarantee & LD to be enclosed.
4. Relevant pages of Tech Specs to be enclosed.

QUALITY PLAN

Quality Assurance and Quality Plan

1 Typical quality plan is enclosed in specification for guidance. The bidder shall comply with these minimum requirements and shall furnish his own quality plan for approval. The quality plan shall be subjected to customer's / purchaser's approval in the event of order without any cost implication.

2 Manufacturer shall conduct all tests and stage inspections as per the approved quality plan to ensure that the Pumps shall conform to the requirements of this specification and of the applicable codes/ standards.

3 All materials used for manufacture/ fabrication of the Pump components shall be of tested quality.

4 Qualification of welding procedures and welders shall be as per ASME B&PV Code, Section-IX/applicable code.

5 During detailed engineering, the various shop test procedures for DP test, Hydro test, Peformance test, NPSH/Submergence Test etc. as per Approved QAP shall be submitted by bidder along with the quality plan for BHEL/customer approval.

6 Hydraulic tested equipment shall not be packed till the inside surface becomes dry.

7 The pump casing shall be hydrostatically tested at maximum of the following:
a. 2 times the TDH (Total Dynamic Head) at rated capacity (or)
b. 1.5 times the shut-off pressure (or)
c. System Design pressure indicated in TECHNICAL DATA PART-A.

8 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.

9 Inspection of Mandatory spares shall be in line with approved QP for main supply.

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC NO.:PE-TS-999-100-W001		
		CUSTOMER:		QP NO.: PE-QP-999-100-W001 R01	DATE	24.09.2024
		PROJECT :		PO NO.:	DATE	
		ITEM: MISC. PUMPS (HORIZONTAL/VERTICAL)	SYSTEM: CW/ACW/DMCW/PLANT/ COMMON	SECTION:	SHEET 1 OF 4	

S. No.	COMPONENT & OPERATION	CHARACTERISTIC	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY ** M	AGENCY ** B	AGENCY ** C	REMARKS
1	2	3	4	5	6	7	8	9	* D	10			11
					M B/C								
1	RAW MATERIALS												
1.1	CASINGS (INCLUDING BOWLS,DIFFUSERS, STAGE BODIES, DISCH HEAD (IF CAST)), ETC. - (AS APPLICABLE) AND IMPELLER	MECHANICAL AND CHEMICAL PROPS	CR	MECHANICAL AND CHEM. ANALYSIS	ONE/HEAT/BATCH	APPROVED CS DRAWING/DATA SHEET	RELEVANT MATERIAL SPECN.	LAB REPORT/ MTC	√	P	V	V	REFER NOTE 1.
1.2	STUFFING BOX, SUCTION BELL, WEARING RINGS,NECK RINGS, SHAFT SLEEVES	MECHANICAL AND CHEMICAL PROPS	MA	MECHANICAL AND CHEM. ANALYSIS	ONE/HEAT/BATCH	APPROVED CS	RELEVANT MATERIAL SPECN.	LAB REPORT/ MTC	√	P	V	V	
		HARDNESS DIFFERENCE BETWEEN CASING / IMPELLER AND WEARING RING	MA	LAB. TEST	100%	APPROVED CS DRAWING/ DATA SHEET	50 BHN MIN.	LAB, REPORT	√	P	V	V	
1.3	BARS/FORGINGS FOR SHAFTS, LINE SHAFTS	PHYSICAL & CHEMICAL PROPS	CR	MECHANICAL & CHEMICAL ANALYSIS.	1/CAST OR 1/BARS	APPROVED CS DRAWING/DATA SHEET	RELEVANT MATERIAL SPECN.	MILL T.C, OR LAB.REPORT	√	P	V	V	CORRELATION REQUIRED, IDENTIFICATION AS PER TC
		INTERNAL DEFECTS FOR 40MM & ABOVE DIA SHAFTS.	CR	ULTRA SONIC TEST	100%	ASTMA388 BACK WALL ECHO 100%	DEFECT ECHO MAX 20% OF B.W.E. LOSS OF BACK WALL ECHO 20% MAX	NDT CERTIFICATE	√	P	V	V	
1.4	STRESS RELIEVING/ HEAT TREATMENT OF CASTING OF ALL ABOVE (IF APPLICABLE) / SOLUTION ANNEALING OF SS CASTING	1. VERIFICATION OF HT CHART	MA	VERIFICATION OF SR/HT CHART	ALL BATCHES	RELEVANT MATERIAL SPECN.	RELEVANT MATERIAL SPECN.	CORRELATED SR/HT.CHARTS	√	P	V	V	
		2. IGC TEST FOR SS CASTING	MA	LAB. TEST	ONE SAMPLE/ HT BATCH	ASTM A 262	ASTM A 262 Gr A	LAB, REPORT	√	P	V	V	
1.5	SHAFT ENCLOSING TUBES, COLUMN PIPES & DISCHARGE ELBOW	1. MECHANICAL & CHEMICAL PROPS. 2. DIMENSIONS. 3. SURFACE FINISH	MA	1. MECH & CHEM TEST 2. MEASUREMENT 3. VISUAL EXAM	1/BATCH 100% 100%	APPROVED GA DRG./DATA SHEET	RELEVANT MATERIAL SPECN./MAFG./ APPROVED DOCS	MFR T.C OR LAB. REPORT	√	P	V	V	
1.6	PLATE FLANGE, C/FLANGE	1. MECHANICAL & CHEMICAL PROS. 2. DIMENSIONS. 3. SURFACE FINISH	MA	1. MECH & CHEM TEST 2. MEASUREMENT 3. VISUAL EXAM	1/CAST 100% 100%	APPROVED GA DRG./DATA SHEET	RELEVANT MATERIAL SPECN./ MFR. DRG./ APPROVED DOC	MILL TC/ LAB REPORT	√	P	V	V	CORRELATION REQ. FOR MAT. OTHER THAN IS 2062
1.7	SUCTION STRAINER (IF APPLICABLE)	MECHANICAL & CHEMICAL PROS.	MI	MECH. & CHEMICAL TEST	1/HEAT	APPROVED GA DRG./DATA SHEET	RELEVANT MATERIAL SPECN./ MFR. DRG./ APPROVED DOC	MILL TC/ LAB REPORT	√	P	V	V	
1.8	PUMP CASING, IMPELLER, DIFFUSER, SHAFT	PMI (MATERIAL GRADE IDENTIFICATION)	CR	RECORD	100%	MANUFACTURER'S TEST PROCEDURE	MANUFACTURER'S TEST PROCEDURE	REPORT	√	P	V	V	
1.9	a. MECHANICAL SEAL b. PUMP BEARINGS	TYPE, SIZE, MFRS, NO., MAKE	MA	VISUAL EXAM	100%	APPROVED DATASHEET / GA	APPROVED DATASHEET		√	P	V	V	COMPLIANCE TC FOR APPROVED MAKE

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name				Sign & Date	Name	Seal
Prepared by:	Prashant Agarwal	PRASHANT AGARWAL	Checked by:	Gaurav Garg	GAURAV GARG	93 Seal		Reviewed by:			
Reviewed & Approved by:	Vishal Kumar Yadav	VISHAL KR. YADAV	Reviewed by:	HARISH KUMAR	HARISH KUMAR			Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC NO.:PE-TS-999-100-W001	DATE	
		CUSTOMER:		QP NO.: PE-QP-999-100-W001 R01	DATE	24.09.2024
		PROJECT :		PO NO.:	DATE	
		ITEM: MISC. PUMPS (HORIZONTAL/VERTICAL)	SYSTEM: CW/ACW/DMCW/PLANT/ COMMON	SECTION:	SHEET 2 OF 4	

S. No.	COMPONENT & OPERATION	CHARACTERISTIC	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY **			REMARKS
										M	B	C	
1	2	3	4	5	6	7	8	9	* D	10			11
					M B/C								
2.0	IN PROCESS CONTROL												
2.1	IMPELLER	DYNAMIC BALANCING	CR	DYNAMIC BALANCING	100%	ISO 1940	ISO1940 Gr 6.3	BALANCING CERTIFICATE	√	P	W	V	WTNESSING ONLY FOR SIZE GREATER THAN 10KW
2.2	IMPELLER-ALL ACCESSIBLE SURFACES, DIFFUSERS, SHAFT	DP TEST	MA	DP TEST ON M/CED AREA	100%	ASTM E 165	NO RELEVANT INDICATION ALLOWED	NDT CERTIFICATE	√	P	W	V	
2.3	WEARING RING, SHAFT SLEEVES, CASING	DP TEST	MA	DP TEST ON M/CED AREA	100%	ASTM E 165	NO RELEVANT INDICATION ALLOWED	NDT CERTIFICATE	√	P	V	V	
2.5	CASINGS/ BOWLS, STAGE BODIES, DISCHARGE HEAD (IF CAST), SUCTION HOUSING, COLUMN PIPE DISCHARGE PIPE ETC	LEAK TIGHTNESS	CR	HYDRO TEST	100%	APPROVED TECHNICAL DATA SHEET	NO LEAKAGE FOR TEST DURATION OF 30 MIN.	HT CERTIFICATE	√	P	W	V	1. HAMMERING OF CASTINGS WITH WOODEN/ RUBBER MALLET BEFORE HYDRO TEST 2. NO WELD REPAIRS PERMITTED ON CI CASTING
2.6	FABRICATED COMPONENTS												
2.6.1	a. WELDING PROCEDURE SPECIFICATION b. WELDING PROCEDURE QUALIFICATION RECORD c. WELDER PERFORMANCE QUALIFICATION	CORRECTNESS	MA	VERIFICATION	100%	ASME SEC.IX	ASME SEC.IX	ASME SEC.IX	√	P	V	V	WELDING PROCEDURE APPROVAL BY BHEL ALT. 3RD PARTY (LLYODS,BVQI OR EQ.) IS ACCEPTABLE.
2.6.2	WELD & ASSEMBLY FIT UPS	DIMENSION & ALIGNMENT	MA	MEASUREMENT, VISUAL EXAMINATION	100%	WPS/MFG DRG	WPS/MFG DRG	IR/LOG BOOK	√	P	V	V	
2.6.3	WELDMENTS	SURFACE DEFECTS	MA	PENETRANT TEST	100% | 10%	ASTM E 165	ASME-VIII,DIV I	INSPN REPORT	√	P	W	V	10%WITNESS BY BHEL & VERIFICATION BY CUSTOMER
2.6.4	BUTT WELDS	INTERNAL DEFECT	MA	UT/RT	100%	ASME SEC. V	ASME-VIII,DIV I	IR	√	P	W	V	WITNESSING OF U.T

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Prepared by:	Prashant Agarwal	PRASHANT AGARWAL	Checked by:	Gaurav Garg	GAURAV GARG	Seal		Reviewed by:			
Reviewed & Approved by:	Vishal Kumar Yadav	VISHAL KR. YADAV	Reviewed by:	HARISH KUMAR	HARISH KUMAR	94		Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC NO.:PE-TS-999-100-W001	DATE	
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S. No.	COMPONENT & OPERATION	CHARACTERISTIC	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY **			REMARKS
										M	B	C	
1	2	3	4	5	6	7	8	9	* D	10			11
					M B/C								
3.0	SUB-ASSEMBLY CONTROL												
3.1	ROTOR ASSEMBLY	ECCENTRICITY	MA	MEASUREMENT	100%	APPROVED GA DRG/ MFR.DRAWING	APPROVED GA DRG/ MFR.DRAWING	IR/LOG BOOK	√	P	V	V	
3.2	ROTOR ASSEMBLY RESIDUAL UNBALACE	STATIC & DYNAMIC	CR	STATIC & DYNAMIC BALANCING	100%	ISO 1940	ISO1940 Gr 6.3	BALANCING CERTIFICATE	√	P	W	V	WTNESSING ONLY FOR SIZE GREATER THAN 10KW
3.3	COMPLETE PUMP ASSEMBLY	COMPLETENESS, CORRECTNESS, CLEANLINESS, CLEARANCES, FREENESS, ALIGNMENT	MA	VISUAL EXAM, MEASUREMENT	100%	APPROVED DRG & MFG STANDARDS	APPROVED DRG & MFG STANDARDS	I.R. & CHECK LISTS	√	P	V	V	KEY SLOT IN SHAFT/COUPLING & VMS PAD AS PER APPROVED GA/CS DRAWING TO BE SPECIFICALLY CHECKED (AS APPLICABLE)
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 **(MIN. 2 HRS OF CONTINUOUS PUMP RUN IS REQUIRED DURING PERFORMANCE TEST)**	100%	APPD. PERFORMANCE TEST PROCEDURE/ APPD. DATA SHEET/APPD. CURVES FOR VIBRATIONS - AS PER ANSI/HIS 9.6.4-2009 (VALUES AS PER APPROVED DATA SHEET) FOR BEARING TEMP - BEARING HOUSING SHOULD NOT BE UNTOUCHABLY HOT. FOR LEACKAGE - MINOR LEKAGE (DROP BY DROP) IN CASE OF GLAND PACKING ARRANGEMENT.	I.R., PERF. TEST RECORD, PLOTED CURVES	√	P	W	W	* MINIMUM 7 POINTS FROM SHUT-OFF TO MAX. OPERATING FLOW COVERING ENTIRE OPERATION RANGE OF PUMP SHALL BE TAKEN. * CUSTOMER HOLD POINT
		NPSH REQUIRED	CR	NPSH TEST	1/MODEL	APPD. PERFORMANCE TEST PROCEDURE/ APPD. DATA SHEET/APPD. CURVES		IR. NPSH TEST RECORD, PLOTED CURVES	√	P	W	W	

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S. No.	COMPONENT & OPERATION	CHARACTERISTIC	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY **			REMARKS
										M	B	C	
1	2	3	4	5	6	7	8	9	* D	10			11
					M B/C								
4.2	STRIP DOWN AFTER PERFORMANCE TEST	UNDUE WEAR TEAR AND RUBBING	MA	VISUAL EXAM AFTER STRIPPING	1/MODEL	NO UNDUE WEAR TEAR & RUBBING ON IMPELLER & WEAR RING		INSP. REPORT	√	P	W	W	WITNESS REQUIRED ONLY WHEN ABNORMAL SOUND OBSERVED DURING PERFORMING TEST.
4.3	COMPLETE PUMP WITH UNIT MOTOR BASE FRAME, COUNTER FLANGES ETC. INCLUDING ALL ACCESSORIES AS PER SECTION C OF SPECN.	COMPLETENESS, CLEANLINESS, OVERALL DIMENSIONS ORIENTATION, WORKMANSHIP AND FINISH	MA	VISUAL EXAM MEASURMENT	100%	APPD. G.A DRAWING	APPD. G.A DRAWING	INSP. REPORT	√	P	W	V	REFER NOTE 2 & 3.
4.4	PAINTING	SURFACE FINISH, DFT, MARKINGS ETC.	MA	VISUAL EXAM, MEASURMENT, AESTHETIC	100%	APPD.DRG.	APPD.DOCS	IR.	√	P	V	V	
4.5	PACKING, MARKING	SOUNDNESS OF PACKING	MI	VISUAL, AESTHETIC	100%	TECHNICAL SPECIFICATION/ MFG. STANDARD	TECHNICAL SPECIFICATION/ MFG. STANDARD	PHOTOGRAPHS	√	P	V	-	

NOTES:

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

2. 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.

3. KEY NOTCH FOR VMS TO BE ENSURED FOR APPLICABLE PUMPS.

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

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
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Prepared by:	Prashant Agarwal	PRASHANT AGARWAL	Checked by:	Gaurav Garg	GAURAV GARG	96 Seal		Reviewed by:			
Reviewed & Approved by:	Vishal Kumar Yadav	VISHAL KR. YADAV	Reviewed by:	HARISH KUMAR	HARISH KUMAR			Approved by:			

CLAUSE NO.	QUALITY ASSURANCE	एनटीपीसी NTPC

	EQUIPMENT COOLING WATER SYSTEM												
	TEST / CHECKS / ITEM / COMPONENTS	Material Test	WPS/PQR/Welder Qualification	DPT/MPI	Assembly Fit Up	Visual & Dimensional Check	UT	RT	Hydraulic / Water Fill	Balancing	Type Test	Performance Test	Other Test
A	**PLATE TYPE HEAT EXCHANGER**		Y	Y[3]	Y	Y			Y				
A.1	Heat Transfer Plates	Y[1]		Y[2]		Y							Y[7]
A.2	Gaskets	Y				Y							
A.3	Cover Plates (Front & Rear)	Y[1]				Y	Y[5]						
A.4	Tie Rods	Y[1]		Y[4]			Y[6]						
B	**HORIZONTAL CENTRIFUGAL PUMP**				Y	Y						Y[10]	
B.1	Casing	Y[1]		Y[4]		Y			Y[8]				
B.2	Impeller	Y[1]		Y[4]		Y				Y[9]			
B.3	Shaft	Y[1]		Y		Y	Y[6]			Y[9]			

NOTES

1 One per heat / HT batch

2 DP Test shall be conducted for 10% of the lot of HT plates. However, in case of any defect, entire lot shall be tested and only defect free plates shall be accepted.

3 100% DP Test shall be conducted on butt welds and 10% DPT on fillet weld after final run.

4 100% DPT shall be carried out on machined surfaces.

5 UT shall be done on plates with thickness >40 mm and for pressure parts plates 25 mm or above.

6 UT shall be done on shaft / tie rod with diameter 40 mm or above.

7 After pressing each HT plate shall be subjected to either of the following tests, as per Manufacturer Practice
a) Light Box Test b) Vacuum Test c) Air Chamber Test

8 All pressure retaining parts shall be hydrostatically tested at 200% of pump rated head or 150% of shut – off head, whichever is higher, for at least 30 minutes. No leakage is allowed.

9 Static and Dynamic Balancing shall be carried out on complete rotor assembly.

10 All pumps shall be tested at rated speed, for head, flow capacity, efficiency and power consumption for the entire operating range i.e. from shut off head to maximum flow. A minimum of 7 readings shall be taken to plot the curve, with one reading at design flow. Testing standard shall be HIS (Hydraulic Institute Standard) of USA.
Performance test shall be carried out with contract motor, wherever Liquidated Damages are to be ascertained based on performance test at shop.

11. For pipes, fittings, valves & RE joints refer QA chapters of LP Piping.

RAW WATER SYSTEM EQUIPMENT

Items / Components \ Tests/Check		Material Test	DPT/MPI	Ultrasonic test	RT	Balancing	Hydraulic / Water Fill test	Pneumatic Test	Assembly/ fit up	Dimensions	Functional/operational Test	Performance Test	Other Test	All Test as per relevant Std/ Approved Data Sheets	Remarks
A.	**VT PUMPS & CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL), SUMP PUMPS, SUBMERSIBLE PUMPS, DRAINAGE PUMP**								Y[1]	Y		Y[2]			
1	Shaft	Y[a]	Y[b]	Y[c]		Y				Y					
2	Impeller	Y[a]	Y[b]		Y[3]	Y							Y[d]		
3	Suction Bell / Bowl Castings/ Inserts	Y[a]	Y[b]				Y			Y			Y[6]		
4	Discharge Head / Column Pipes / Distance Piece/Base Plate	Y[a]	Y[b]	Y[c]	Y[4]		Y		Y						
5	Companion Flanges	Y[a]	Y[b]	Y[c]	Y[5]				Y						
5	Thrust Bearing (Tilting Pad type)	Y[a]	Y	Y					Y	Y				Y	
B.	**RE JOINTS**	Y[a]					Y[10]		Y	Y			Y[11]		
C.	**CRANES & HOISTS**	**REFER BELOW FOR QA CHECKS ON EOT CRANES AND HOISTS**													
E.	**VENTILATION FANS**									Y		Y		Y	
1)	Hub/Blades/Casing /Impeller	Y	Y			Y									
2)	Shaft	Y[a]	Y	Y[c]											
3)	Pre/Fine Filters												Y[14]		

Notes:

a	One per Heat/ Heat Treatment Batch/ Lot.
b	On machined surfaces only for Castings / Forgings and on Welds of Fabricated Components.
c	For Shaft diameter. ≥ 50 mm and for plate thickness ≥ 25 mm

d	Inter Grannular Corrosion (IGC) Test shall be carried out on SS Castings.
1	Trial assembly of all Vertical Turbine Pump components with Column Pipes, Discharge Head, and Motor Stool shall be carried at shop.
2	Performance testing of Pumps shall be carried out at shop, as per HIS standard to determine Head & Flow Characteristics.
3	In case of pump impellers, Radiographic Examination shall be conducted as per ASTM E186/446 with Severity Level 2 for Gas porosity, Level 3 for Sand, Slag and Shrinkage. Cracks, Inserts and Mottling are not acceptable. Radiographic Examination should cover Vanes, Vane Junctions, Full Radial depth of Hub & other accessible areas of the rest of the Impeller.
4	Random 10% RT to be conducted on butt welds for Thk ≥ 10 mm & ≤ 25 mm and 100% RT to be conducted on butt welds for Thk > 25 mm (RT may be replaced by Ultrasonic Test due to constraint if any.) Stress relieving shall be carried out as per norms of ASME Section VIII.
5	Segmental Flanges exceeding 37.5 mm thickness shall be stress relieved after welding. All butt weld joints in segmental flange shall be examined by Radiographic Test. (RT may be replaced by Ultrasonic Test due to constraint if any.) Maximum number of segments shall be 4 only.
6	No repair welding is permitted on Cast Iron / Alloy Cast Iron Castings.
7	Hydraulic Test of Body, Seat and Disc strength shall be carried out in accordance with latest edition of AWWA C-504. Actuator operated Valves shall be checked for Seat Leakage by closing the Valve with Job Actuator. Seat Leakage test shall be carried out in both directions.
8	For Proof of Design Test refer respective chapters of engineering portion in the technical specification.
9	For Butterfly Valves of Fabricated construction (Sizes 600mm and above), butt Welds of thickness 20mm & above shall be subjected to 100% Radiography and Components shall undergo stress relieving.
10	During Hydraulic & Vacuum test at 30 mm Hg absolute in 3 different positions, the change in Circumference of the Arch should not be more than 1.5%. Permanent Set, after 24 hours of the test, should not exceed 0.5% of Arch.
11	Tests on Rubber for Tensile, Elongation, Hardness, Hydraulic Stability as per ASTM D-471, Ozone Resistance test as per ASTM D-1149, Aging test, Adhesion strength of Rubber to Fabric and Rubber to Metal shall be carried out.
14	Type / Routine tests as per requirements of BS-6540/ ASHRAE-52-76 for Dust arrestance shall be carried out.

CLAUSE NO.	QUALITY ASSURANCE	एनटीपीसी NTPC

	EQUIPMENT COOLING WATER SYSTEM												
	TEST / CHECKS / ITEM / COMPONENTS	Material Test	WPS/PQR/Welder Qualification	DPT/MPI	Assembly Fit Up	Visual & Dimensional Check	UT	RT	Hydraulic / Water Fill	Balancing	Type Test	Performance Test	Other Test
A	**PLATE TYPE HEAT EXCHANGER**		Y	Y[3]	Y	Y			Y				
A.1	Heat Transfer Plates	Y[1]		Y[2]		Y							Y[7]
A.2	Gaskets	Y				Y							
A.3	Cover Plates (Front & Rear)	Y[1]				Y	Y[5]						
A.4	Tie Rods	Y[1]		Y[4]			Y[6]						
B	**HORIZONTAL CENTRIFUGAL PUMP**				Y	Y						Y[10]	
B.1	Casing	Y[1]		Y[4]		Y			Y[8]				
B.2	Impeller	Y[1]		Y[4]		Y				Y[9]			
B.3	Shaft	Y[1]		Y		Y	Y[6]			Y[9]			

NOTES

1 One per heat / HT batch

2 DP Test shall be conducted for 10% of the lot of HT plates. However, in case of any defect, entire lot shall be tested and only defect free plates shall be accepted.

3 100% DP Test shall be conducted on butt welds and 10% DPT on fillet weld after final run.

4 100% DPT shall be carried out on machined surfaces.

5 UT shall be done on plates with thickness >40 mm and for pressure parts plates 25 mm or above.

6 UT shall be done on shaft / tie rod with diameter 40 mm or above.

7 After pressing each HT plate shall be subjected to either of the following tests, as per Manufacturer Practice
a) Light Box Test b) Vacuum Test c) Air Chamber Test

8 All pressure retaining parts shall be hydrostatically tested at 200% of pump rated head or 150% of shut – off head, whichever is higher, for at least 30 minutes. No leakage is allowed.

9 Static and Dynamic Balancing shall be carried out on complete rotor assembly.

10 All pumps shall be tested at rated speed, for head, flow capacity, efficiency and power consumption for the entire operating range i.e. from shut off head to maximum flow. A minimum of 7 readings shall be taken to plot the curve, with one reading at design flow. Testing standard shall be HIS (Hydraulic Institute Standard) of USA.
Performance test shall be carried out with contract motor, wherever Liquidated Damages are to be ascertained based on performance test at shop.

11. For pipes, fittings, valves & RE joints refer QA chapters of LP Piping.

CLAUSE NO **QUALITY ASSURANCE**

Items / Components \ Tests/Check		Material Test	DPT/MPI	Ultrasonic test	RT	Balancing	Hydraulic / Water Fill test	Pneumatic Test	Assembly/ fit up	Dimensions	Functional/operational Test	Performance Test	Other Test	All Test as per relevant Std/ Approved Data Sheets	Remarks
A.	**CW PUMPS, VT PUMPS & CENTRIFUGAL PUMPS (HORIZONTAL / VERTICAL), SUMP PUMPS, SUBMERSIBLE PUMPS, DRAINAGE PUMP**								Y[1]	Y		Y[2]			
1	Shaft	Y[a]	Y[b]	Y[c]		Y				Y					
2	Impeller	Y[a]	Y[b]		Y[3]	Y							Y[d]		
3	Suction Bell / Bowl Castings/ Inserts	Y[a]	Y[b]				Y			Y			Y[6]		
4	Discharge Head / Column Pipes / Distance Piece/Base Plate	Y[a]	Y[b]	Y[c]	Y[4]		Y		Y						
5	Companion Flanges	Y[a]	Y[b]	Y[c]	Y[5]				Y						
5	Thrust Bearing (Tilting Pad type)	Y[a]	Y	Y					Y	Y				Y	
B.	**BUTTERFLY VALVES**						Y[7]		Y	Y	Y		Y[8]	**Y**	
1	Body & Disc (Cast)	Y[a]	Y[b]												
2	Body & Disc (fabricated)	Y[a]	Y[b]	Y[c]									Y[9]		
3	Shaft	Y[a]	Y[b]	Y[c]											
4	EH Actuators	Y[a]	Y				Y	Y	Y		Y				
C.	**RE JOINTS**	Y[a]					Y[10]		Y	Y			Y[11]		
D.	**R & W PIPES**	Y[a]	**REFER NOTE 13**												
E.	**CRANES & HOISTS**	**REFER RESPECTIVE QA CHAPTERFOR FOR CHECKS ON EOT CRANES AND HOISTS**													

CLAUSE NO	QUALITY ASSURANCE	एनटीपीसी NTPC

F.	**VENTILATION FANS**									Y		Y		Y	
1)	Hub/Blades/Casing /Impeller	Y	Y			Y									
2)	Shaft	Y[a]	Y	Y[c]											
3)	Pre/Fine Filters												Y[14]		
H.	**GATE, GLOBE, CHECK VALVES, PIPINGS, & SPECIALITIES**	Y[a]	Y[b]	Y[c]			Y[15]		Y	Y	Y	Y	Y[15]	Y	

Notes:

a	One per Heat/ Heat Treatment Batch/ Lot.
b	On machined surfaces only for Castings / Forgings and on Welds of Fabricated Components.
c	For Shaft diameter. ≥ 50 mm and for plate thickness ≥ 25 mm
d	Inter Grannular Corrosion (IGC) Test shall be carried out on SS Castings.
1	Trial assembly of all Vertical Turbine Pump components with Column Pipes, Discharge Head, and Motor Stool shall be carried at shop.
2	Performance testing of Pumps shall be carried out at shop, as per HIS standard to determine Head & Flow Characteristics.
3	In case of CW pump impellers, Radiographic Examination shall be conducted as per ASTM E186/446 with Severity Level 2 for Gas porosity, Level 3 for Sand, Slag and Shrinkage. Cracks, Inserts and Mottling are not acceptable. Radiographic Examination should cover Vanes, Vane Junctions, Full Radial depth of Hub & other accessible areas of the rest of the Impeller.
4	Random 10% RT to be conducted on butt welds for Thk ≥ 10 mm & ≤ 25 mm and 100% RT to be conducted on butt welds for Thk > 25 mm (RT may be replaced by Ultrasonic Test due to constraint if any.) Stress relieving shall be carried out as per norms of ASME Section VIII.
5	Segmental Flanges exceeding 37.5 mm thickness shall be stress relieved after welding. All butt weld joints in segmental flange shall be examined by Radiographic Test. (RT may be replaced by Ultrasonic Test due to constraint if any.) Maximum number of segments shall be 4 only.
6	No repair welding is permitted on Cast Iron / Alloy Cast Iron Castings.
7	Hydraulic Test of Body, Seat and Disc strength shall be carried out in accordance with latest edition of AWWA C-504. Actuator operated Valves shall be checked for Seat Leakage by closing the Valve with Job Actuator. Seat Leakage test shall be carried out in both directions.
8	For Proof of Design Test refer respective chapters of engineering portion in the technical specification.
9	For Butterfly Valves of Fabricated construction (Sizes 600mm and above), butt Welds of thickness 20mm & above shall be subjected to 100% Radiography and Components shall undergo stress relieving.

10	During Hydraulic & Vacuum test at 30 mm Hg absolute in 3 different positions, the change in Circumference of the Arch should not be more than 1.5%. Permanent Set, after 24 hours of the test, should not exceed 0.5% of Arch.
11	Tests on Rubber for Tensile, Elongation, Hardness, Hydraulic Stability as per ASTM D-471, Ozone Resistance test as per IS:3400 Part 20, Aging test, Adhesion strength of Rubber to Fabric and Rubber to Metal shall be carried out.
12	Smooth operation and Leakage test shall be carried out at site.
13	Followings are the testing requirements for fabrication of pipes at site

Tests	**Quantum of Check**
WPS, PQR, Welder Qualification Test	100%
DPT on root run	100% for pipes up to 1200 mm diameter
DPT after back gauging	100% for pipes above 1200 mm diameter
RT/ UT by TOFD Technique/PAUT	5%
DPT on finished butt weld joints	10%
Hydraulic Test	100%, 1.5 times the design pressure or 2 times the working pressure which ever is higher.

	Note:- After erection, the complete piping system shall be tested at 1.5 times, the design pressure or two times the maximum working pressure whichever greater. No leakage/seepage is acceptable. Butt weld joints which would not be hydro-tested shall be subjected to 100% RT test/ 100% UT by TOFD /PAUT Technique.
14	Type / Routine tests as per requirements of BS-6540/ ASHRAE-52-76 for Dust arrestance shall be carried out.
15	a. All pipes and fittings shall be tested as per applicable code. b. All strainers shall be subjected to Hydraulic pressure test for leakage. c. All valves shall be hydraulically tested for body, seat and back-seat (if applicable) as per relevant standard. Check valves shall also be tested for leak tightness test at 25% of the specified seat test pressure. d. Valves shall be offered for hydro test in unpainted condition. e. Functional checks of the valves for smooth opening and closing shall also be done. f. Anti-corrosive protection shall be tested as per applicable code.

LOW PRESSURE PIPING

PIPES, FITTINGS, BENDS, VALVES, COATING-WRAPPING, STRAINERS EXPANSION, JOINTS, TANKS, FASTENERS, LINING ETC.

	Tests/Check / Items / Components	Material Test	DPT/MPI / RT	Ultrasonic Test	WPS/ WQS/PQR	Hydraulic / Water Fill Test	Pneumatic Test	Assembly Fit up	Dimensions	Functional/operational Test	Other Tests	All Tests as per relevant Std	REMARKS
1	Pipes & Pipe Fittings	Y[a]	Y[b]			Y1			Y			Y	
2	Diaphragm Valves	Y[a]				Y[5]			Y		Y[6]		
3A	Cast Butterfly Valves (Low Pressure)					Y		Y	Y	Y	Y[7]		
	Body	Y[a]	Y[b]										
	Disc	Y[a]	Y[b]										
	Shaft	Y[a]	Y	Y[c]									
3B	Fabricated Butterfly Valves	**REFER NOTE 14**											
4	Gate/ Globe/Swing Check / Ball Valves	Y[a]	Y[b]	Y[c]		Y[5]	Y	Y	Y	Y	Y[8]		
5	Dual Plate Check Valves	Y[a]	Y[b]	Y[c]		Y	Y	Y	Y	Y	Y[4]		
6	Rolled & Welded Pipes and Mitre Bends	Y[a]	Y[3]		Y	Y[3]			Y		Y[3&15]	Y	
7	Coating & Wrapping of Pipes	Y[2]									Y[2]		
8	Tanks & Vessels	Y[a]	Y[b]		Y	Y			Y		Y[16]		
9	Strainers	Y[a]	Y[b]		Y #	Y					Y[11]		#For Fabricated Strainer
10	Rubber Expansion Joints	Y[a]				Y[12]		Y	Y		Y[13]		
11	Internal Lining of Pipes	Y[a]							Y		Y[9]		
12	Site Welding		Y[10]		Y	Y							

NOTES (MEANING OF SUPERSCRIPTS)

a	One per heat/heat treatment batch/lot.
b	On machined surfaces only for castings and on butt welds.
c	For shaft/spindles > or = 40 mm
1	100% Hydraulic test shall be carried out. Weld joints not subjected to hydraulic test due to some unavoidable reasons, shall be subjected to 100% RT/PAUT.
2	Spark Test, Adhesion Test and Material Test for primer and enameled & Coal Tar Tapes as per AWWA-C-203-91/ IS-10221 & IS 15337 as applicable.
3	Followings are the testing requirements for fabrication of pipes at site

TESTS	QUANTUM OF CHECKS
WPS, PQR, Welder Qualification Test	100% Welders and WPS shall be qualified as per ASME- section IX
DPT on root run	100% for pipes up to 1200 mm diameter
DPT after back gauging	100% for pipes above 1200 mm diameter
RT / UT by (TOFD/PAUT) Technique	5% (100% of T Joints)

LOW PRESSURE PIPING

	DPT on finished butt weld joints	10%
	Hydraulic Test	100%, 1.5 times the design pressure or 2 times the working-pressure whichever is higher.
4	Dry Cycle Test on Dual Plate Check valve spring for one lakh Cycles shall be carried out as a type test. If Dry Cycle test carried out earlier for same material & diameter, Test report shall be reviewed.	
5	Seat Leakage Test for Actuator Operated Valves, shall be done with by closing the valves with actuator.	
6	Tests on rubber parts shall be conducted per batch of rubber mix for tensile, Elongation, hardness, adhesion, spark test, bleed resistance test. In addition, type test for 50,000 cycles of each type of diaphragm shall also be conducted.	
7	Hydraulic Test of Body, Seat and disc-strength shall be carried out in accordance with governing design standard in presence of owner / owner's representatives. Actuator operated valves shall be checked for Seat Leakage by closing the valves with actuator. For Proof of Design Test refer respective chapters of engineering portion in the technical specification.	
8	Blue matching, wear travel for gates, valves, pneumatic seat leakage, and reduced pressure test for check valves shall be done as per relevant standard. Maximum allowable vacuum loss is 0.5 mm of Hg abs. for valves to be tested for vacuum operation for internal pressure 25 mm of Hg abs. for a period of 15 minutes. Fire safe test for ball valve shall be done wherever specified. In case of already carried out, the test report shall be submitted for review and acceptance by owner / owner's representatives. Valves shall be offered for hydro test in unpainted condition.	
9	Tensile, Elongation, Hardness, Specific Gravity, Lining Thickness, Humidity Check, Pipe temperature check, Adhesion Test and Holiday Detection Test etc as per applicable standard shall be done for all lining material and application.	
10	10% of welds (Root and finished welds) shall be subjected to DPT. (100% DPT for compressed air line and boiler & deaerator fill line.).	
11	Pressure drop across the strainer for each type and size as a special test shall be carried out. In case of already carried out, the test report shall be submitted for review and acceptance by owner / owner's representatives.	
12	During hydraulic and vacuum tests at 25mm Hg abs in 3 positions, the change in the circumference of arch should not be more than 1.5%. 24 hrs after the test permanent set in dimension should not exceed 0.5%.	
13	Tests on rubber for tensile, elongation, hardness, hydraulic stability check as per ASTM D 471, ozone resistance test as per ASTM D 1149/IS 3400 Part 20 aging test and adhesion strength of rubber to fabric, rubber to metal adhesion shall be carried out.	
14	In addition of all tests as indicated for Cast Butterfly valve being applicable for fabricated butterfly valves, following test shall be done for Fabricated Butterfly Valve: a. UT as per ASTM A-435/IS 11630 & IS 4225 on plate material for body and disc shall be carried out for plate thickness 25mm and above. b. 100% RT and DPT as per ASTM, Section-VIII, Division-I, on butt joins of body and disc. 10% DPT on other welds shall be done. c. Post weld heat treatment as per ASME, Section-VIII, Division-I on butt joints of body and disc. d. Welders and WPS shall be qualified as per ASME- section IX	
15	Maximum number of segments in segmental flanges shall be four (04) only. All butt weld joints in the segmental flanges shall be examined by RT/UT. Segmental flanges exceeding 37.5 mm thickness shall be stress relieved as per norms of ASME Section VIII after welding.	
16	For pressure vessel welds RT shall be done as per design code requirements.	

All Valves shall be offered for inspection in unpainted condition.

No repair welding is permitted on Cast Iron / Alloy Cast Iron Castings.

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN	SPEC. NO :	DATE:
	CUSTOMER :	QP NO.: PE-QP-999-Q-006, REV-02	DATE: 17.04.2020
	PROJECT:	PO NO.:	DATE:
	ITEM: AC ELECT. MOTORS UPTO 50 KW (415V) / SYSTEM:	SECTION: II	SHEET 1 of 2

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

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

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-Q-006, REV-02	DATE: 17.04.2020
		PROJECT:		PO NO.:	DATE:
		ITEM: AC ELECT. MOTORS UPTO 50 KW (415V)	SYSTEM:	SECTION: II	SHEET 2 of 2

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

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

LEGENDS:

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

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

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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

QP FOR MOTORS ABOVE 50 KW

CLAUSE No. CHAPTER NAME

MOTOR

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

CLAUSE No. CHAPTER NAME

Accessories, RTD, BTD, CT, Space heater, antifriction bearing, gaskets etc.	Y	Y	Y															
Complete Motor	Y	Y	Y											Y	Y	Y	Y1	Y

Note:

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

Note for LT Motor:

i) Motor rating up to 50 KW: Inspection CAT- III : Acceptance of Motor up to 50 KW is based on COC of the Manufacturer and Main Contractor confirming as follows:
"It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage frequency variation, hot s
KVA/KW, temperature rise, distance between center of stud gland plate and tested in accordance with approved drawing /data sheets."

ii) Motor rating above 50 KW & less than 75 KW: Inspection CAT- II as per NTPC approved MQP: Acceptance of Motor rating above 50 KW & less than 75 KW is based on NTPC rev
report as per IS:12615 - 2018 (including latest revision) duly witnessed by main contractor along with COC of the Manufacturer and Main Contractor confirming as follows:
"It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage frequency variation, hot s
KVA/KW, temperature rise, distance between center of stud gland plate, space heater and tested in accordance with approved drawing /data sheets."

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

2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard
3. Makes of major bought out items for HT motors will be subject to NTPC approval.
4. Y1 = for HT Motor / Machines only.
5. For LT Motors, stator core stack length & grade, no load loss and winding resistance w.r.t. type tested motor for IE2/IE3 shall be checked/verified in addition to Compliance of relevant standard IS:12615/IEC requirement. In case actual results are not within the tolerance limit as declared by manufacturer during QP submission, the motor shall be subjected to efficiency test.

Note : 1) This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed alongwith relevant supporting documents during QP finalisation.

MEASURING INSTRUMENTS

Item Components Sub System Assembly	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Test as per standard(R)	Insulation Resistance (R)	IBR Certification (As applicable)(R)	Hydro Test(R)	Material Test certificate (R)
Pressure Gauge (IS-3624)	Y	Y	Y	Y	Y				
Electronic Transmitter(IEC-60770)		Y	Y	Y	Y	Y	Y		
RTD(IS-2848)	Y	Y	Y	Y	Y	Y			
Thermowell	Y		Y				Y	Y	Y
R-Routine Test A- Acceptance Test Y – Test applicable									

PROCESS CONNECTION AND PIPING															
Tests Items	Visual & Dimensions ®	GA, BOM, Layout of component & construction feature, Paint	Flattening,flaring,hydrotest,hardness check as per ASTM standard (A)	Component Ratings ®	Wiring ®	Make, Model, Type, Rating®	IR & HV ®	Review of TC for instrument/devices (R)	Accessability of TBs/Devices Illumination,grounding ®	Tubing ®	Leak/Hydro test(A)	Chemical/physical properties of material (A)	Proof pressure test,Dismantling & reassembly test Hydrulic	Tests as per standards & specification
Junction Box	Y	Y*		Y		Y	Y							
Gauge Board	Y	Y		Y		Y		Y		Y	Y			
Impulse pipes and tubes	Y		Y			Y						Y		
Socket weld fittings ANSI B-16.11	Y					Y						Y		Y
Compression fittings	Y					Y					Y	Y	Y	
Instrument valves & Valve manifolds	Y					Y					Y	Y		
Copper tubings ASTM B75	Y					Y								Y
*-applicable for painted junction boxes.														
®-Routine Test A-Acceptance Test Y – Test applicable														

ELECTRICAL ACTUATOR													
Test/Attributes Characteristics _____ ITEM/ COPONENT/ SUB SYSTEM ASSEMBLY/ TESTING	RPM ®	No Load Current ®	IR & HV Test®	Mounting Dimension®	All routine Test as per Standard & Specification®	Correct Phase Sequence®	Operation & Setting of limit Switch/Torque Switch®	Stall Torque/Current (A)	Hand Wheel operation/ Auto de clutch function (A)	Function of Aux. like Potentiometer, space heater, position indicator ®	EPT output ®	Local/ Remote (Open-Stop-Close) Operation®	Safety check (Single phasing, Phase correction, Tripping etc.) (A)
ELECTRICAL ACTUATOR with Integral Starter , Non- Intrusive Electrical Actuator (EN15714-2)													
Motor	Y	Y	Y	Y	Y								
Final Testing	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
® - Routine Test A - Acceptance Test Y - Test applicable													
Note:													
1) SIL 2 certificate													

SUB VENDOR LIST

ANNEXURE-I

INDICATIVE SUB VENDOR LIST OF LT MOTORS

The list of approved make of the LT Motors are as mentioned below:

S.No.	LIST OF LT MOTORS
1.	BHARAT BIJLEE LTD.
2.	CROMPTON GREAVES
3.	ASEA BROWN BOVERI
4.	KIRLOSKAR ELECTRIC CO LTD.
5.	NGEF
6.	SIEMENS
7.	MARATHON
8.	GE-POWER
9.	RAJINDRA ELECT INDUSTRIES
10.	LAXMI HYDRAULICS PVT. LTD.
11.	HAVELLS INDIA LIMITED

However, the final list of makes for the LT Motors is subjected to BHEL/Customer approval, during contract stage, without any commercial implications.

INDICATIVE SUB VENDOR LIST OF CABLE GLANDS AND LUGS

ITEM CODE	ITEM/SERVICE DESCRIPTION	SL NO.	VENDOR CODE	VENDOR NAME	ADDRESS	REMARKS
	CABLE GLANDS	1	E1201	ALLIED TRADERS & EXPORTERS	C-124 A, SECTOR-2, NOIDA -201 301, UTTAR PRADESH, INDIA	
	CABLE GLANDS	2	E1017	ARUP ENGG & FOUNDARY WORKS	391/119,PRINCE ANWAR SHAH ROAD, CALCUTTA-700068	
	CABLE GLANDS	3	E1206	BALIGA LIGHTING EQPT.PVT.LTD.	63A,CP RAMASWAMY ROAD, ALWARPET,P.B.No 6910, CHENNAI-600018	
	CABLE GLANDS	4	E1036	COMMET BRASS PRODUCTS	NUTAN CHEMICAL COMPOUND, WALBHAT ROAD, GOREGAON, MUMBAI-400063	
	CABLE GLANDS	5	DW08	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063.	
	CABLE GLANDS	6	E1044	ELECTROMAC INDUSTRIES	27/28AF NEW EMPIRE IND.ESTT., R.KRISHNA MANDIR RD.JB NGR ,ANDHERI(E),MUMBAI-400059	
	CABLE GLANDS	7	I01	INCAB	HARE STREET,KOLKATA,WEST BENGAL-700001	
	CABLE LUGS	1	E1040	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST).	
	CABLE LUGS	2	E1149	UNIVERSAL MACHINES LTD.	4,B.B.D.BAG (EAST) 90,STEPHEN HOUSE,5TH FLR CALCUTTA-700001	

ANNEXURE-VII

INDICATIVE SUB-VENDOR LIST
LARA SUPER THERMAL POWER PROJECT
STAGE-II (2x800 MW)

ITEM/SERVICE DESCRIPTION	SL NO.	VENDOR NAME	ADDRESS	PHONE	REMARKS
LT MOTOR	1	ABB	FARIDABAD		UPTO 55KW
	2	ABB	BANGALORE		
	3	JYOTI LTD.	VADODARA		
	4	TIPM	JAPAN		UPTO 15 KW (NON FLAME PROOF)
	5	HYOSUNG	SOUTH KOREA		
	6	WEG	BRAZIL		
	7	HYUNDAI	SOUTH KOREA		
	8	LHP	SOLAPUR		
	9	CGL	AHMEDNAGAR		RQP, FOR FLAME PROOF MOTOR
	10	TMEIC	JAPAN (NAGASAKHI)		
	11	NGEF	BANGALORE		UPTO 15 KW
	12	BHARAT BIJLEE	MUMBAI		RQP, FOR FLAME PROOF ALSO
	13	KEC	BANGALORE/ HUBLI*		*UPTO 90KW, RQP, FOR FLAME PROOF ALSO
	14	MARATHON	KOLKATA		RQP (UPTO 690V & 600 KW) FOR FLAME PROOF ALSO
	15	ABB	SWEDEN		UPTO 55KW
	16	HAVELL	NEEMRANA		UP TO 90KW
	17	KAWAMATA	JAPAN		UP TO 75 KW
	18	TIPS	JAPAN		UP TO 45KW
CABLE GLANDS	1	ALLIED TRADERS & EXPORTERS	C-124 A, SECTOR-2, NOIDA -201 301, UTTAR PRADESH, INDIA	Mr. Vijay Mohan Sood +(91)-(120)-2525694 +(91)-(120)-3052594 +(91)-(11)-23287156 vijay_mohansood@yahoo.com	
CABLE GLANDS	2	ARUP ENGG & FOUNDARY WORKS	391/119,PRINCE ANWAR SHAH ROAD, CALCUTTA-700068	033 2473 0850	
CABLE GLANDS	3	BALIGA LIGHTING EQPT.PVT.LTD.	63A,CP RAMASWAMY ROAD, ALWARPET,P.B.No 6910, CHENNAI-600018	44-24995505,22680990-4	
CABLE GLANDS	4	COMMET BRASS PRODUCTS	NUTAN CHEMICAL COMPOUND, WALBHAT ROAD, GOREGAON, MUMBAI-400063	91-022-26852961/62/63 comet@vsnl.net	
CABLE GLANDS	5	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063.	CEO : Mr. Jayantibhai S. Patel TEL: 022-32504770./022-29270876/ 022-29270878.	
CABLE GLANDS	6	ELECTROMAC INDUSTRIES	27/28AF NEW EMPIRE IND.ESTT., R.KRISHNA MANDIR RD.JB NGR ,ANDHERI(E),MUMBAI-400059	91-22-28324829 / 66919034 devang@electromacglands.com	
CABLE GLANDS	7	INCAB	HARE STREET,KOLKATA,WEST BENGAL-700001	91-33-2480161/62/63/64 Fax : 91-33-2485766	
CABLE LUGS	1	DOWELLS	M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063.	CEO : Mr. Jayantibhai S. Patel TEL: 022-32504770./022-29270876/ 022-29270878.	
CABLE LUGS	2	UNIVERSAL MACHINES LTD.	4,B.B.D.BAG (EAST) 90,STEPHEN HOUSE,5TH FLR CALCUTTA-700001	033 2282 2540	

PAINTING REQUIREMENT

1 The surface of SS, Gun metal, brass, bronze and non-metallic component shall not be applied with any painting.
2 The Steel surface to be applied with painting shall be thoroughly cleaned before applying painting by brushing, shop blasting etc. as per the agreed

S No	Condition	Surface Preparation	Primer Coat	No. of Coats	DFT (in Microns)	Intermediate Coat (in Microns)	No. of Coats	DFT (in Microns)	Final Coat	No. of Coats	DFT (in Microns)	Total DFT
1	Indoor/ Outdoor	S.A 2.5 of Swedish Specification no. SIS-05-5900-1967	Epoxy resin based zinc phosphate primer	1	100	Epoxy resin based paint pigmented with Titanium dioxide	1	100	Epoxy paint suitable pigmented with DFT of 75 microns. Additionally finishing coat of polyurethane of minimum DFT of 25 microns	1	100	300

	TECHNICAL SPECIFICATION MISC. PUMPS (VERTICAL) 2X800 MW LARA STAGE-II & 2X800 SINGRAULI STAGE-III	PE-TS-508/512-100-W002 Rev. No. 00 Date : 14.08.25

PACKING REQUIREMENT

Sl.no	DESCRIPTION
1	**Type of Packing:**
1.1	Item shall be fully covered with multi layered cross laminated colourless polyethylene sheet of at least 100 GSM and shall be packed inside wooden box or crate or fixed on wooden pallet depending upon the size.
1.2	Item shall be firmly fixed to the bottom of the packing box/crate/pallet with the help of supports/blocks to arrest the movement from all sides. Internal threads shall be protected with metal plug sealed with Teflon tape (if applicable). External thread shall be protected with PVC sleeve. Flanged opening if any shall be covered with blank flanges sealed with blank gasket of natural rubber or equivalent.
1.3	Loose material, primary and secondary shall be packed in corrugated box and plastic bags with proper tagging.
2	**Quality of wood:**
2.1	**Quality of wood:** Wood used for packing box shall be Pinewood, Rubber wood, Mango wood, Fir wood, Silver Oak wood or other as per availability with moisture content not exceeding 30%.
3	**Moisture protection:**
3.1	External machined C.S. Surfaces shall be protected against corrosion with corrosion resisting coating or grease/ shall be coated with rust preventive primer. Equiment shall be covered with HDPE sheet/ polythene sheet inside the box to prevent from moisture ingress.
4	**Packing slip & holder:**
4.1	Packing slip kept in polyethylene bag shall be placed inside the wooden box at appropriate place.
4.2	One copy of packing slip wrapped in polyethylene bag covered in galvanized iron tin sheet/ aluminium packing slip holder shall be fixed on the external surface the packing box.

BILL OF QUANTITY

	TECHNICAL SPECIFICATION MISC. PUMPS (VERTICAL) 2X800 MW LARA STAGE-II & 2X800 SINGRAULI STAGE-III	PE-TS-508/512-100-W002 Rev. No. 00 Date : 14.08.25
	BOQ SCHEDULE - 2X800MW LARA	

1.0	**Supply of Pumps and Motors:**	**UOM**	**QUANTITY**
1.1	**Raw water (PT) Pumps**		
1.1.1	Pump	Nos.	3
1.1.2	Motor	Nos.	by BHEL
1.1.3	Forced Water Lubrication System	SET	1
1.1.4	Mandatory Spares (as per S.No. 3.0 below)	Lot	1
1.2	**Raw water (Ash) Pumps**		
1.2.1	Pump	Nos.	3
1.2.2	Motor	Nos.	3
1.2.3	RE Joint	Nos.	3
1.2.4	Forced Water Lubrication System	SET	1
1.2.5	Mandatory Spares (as per S.No. 3.0 below)	Lot	1

NOTE: Commissioning & Erection spares, special Tools & tackle and other accessories applicable as per Specification but not listed above shall be included in the price of pump/motor & shall be supplied with the pump/motor.

2.0	**SITE SERVICES:**	**UOM**	**QUANTITY**
2.1	Installation Check at Site as per Specification		
2.1.1	Site Visit Charges	Nos. of Visits	6
2.1.2	Manday Charges at Site	Nos. of Mandays	18
2.2	PG Test of pumps at site as per Specification	Lot	1

NOTE:

1	Service charges at Sl.no 2.1.1 shall include to/fro travel expenses, medical and insurance.
2	Service Charges at Sl.no 2.1.2 shall include boarding/lodging, local conveyance or any other applicable charge for completion of site services. No. of mandays at site defined at Sl.no. 2.1.2 above shall be calculated on the basis of presence at site (travelling time/days is excluded).
3	Payment for Sl. No. 2.1 shall be done based on actual consumed site visits and mandays.

3.0	**Mandatory Spares for**	**UOM**	**QUANTITY**
3.1	**Raw Water (PT) Pumps**		
3.1.1	Impeller with nuts & washers	1.00	SET
3.1.2	Bearings for Line, Head and Impeller shafts	1.00	SET
3.1.3	Thrust Bearings of pump & drive	1.00	SET
3.1.4	Wearing rings – Impeller (if applicable)	1.00	SET
3.1.5	Wearing rings – Casing (if applicable)	1.00	SET

	TECHNICAL SPECIFICATION MISC. PUMPS (VERTICAL) 2X800 MW LARA STAGE-II & 2X800 SINGRAULI STAGE-III	PE-TS-508/512-100-W002 Rev. No. 00 Date : 14.08.25	
	BOQ SCHEDULE - 2X800MW LARA		
3.1.6	Gland, packing & gland assembly	1.00	SET
3.1.7	Impeller Shaft, line shaft and head shaft	1.00	SET
3.1.8	Shaft Sleeves	1.00	SET
3.1.9	Stuffing box	1.00	SET
3.1.10	Pump & Drive Coupling, bushes, pins with all fasteners & coupling guards (as applicable)	1.00	SET
3.1.11	All Gaskets	1.00	SET
3.1.12	Line Shaft Couplings (if applicable)	1.00	SET
3.2	**Spares for Lubrication Water Pumps for Raw water (PT) Pumps**		
3.2.1	Impeller with nuts & other accessories	1.00	SET
3.2.2	Impeller Shaft with fasteners	1.00	SET
3.2.3	Shaft Sleeves	1.00	SET
3.2.4	Wearing rings – Impeller (if applicable)	1.00	SET
3.2.5	Wearing Rings – Casing (if applicable)	1.00	SET
3.2.6	Pump bearings	1.00	SET
3.2.7	Thrust bearings	1.00	SET
3.2.8	Pump & Drive Coupling compl. assy. & coupling Guards	1.00	SET
3.2.9	Pump to drive coupling bushes with fasteners	1.00	SET
3.2.10	Gland, Packing & Gland Assembly / Mech. seal as applicable	1.00	SET
3.2.11	Motor for Lubrication Water Pumps	1.00	Nos
3.3	**C&I Spares for Raw Water (PT) Pumps & Lubrication System (If applicable)**		
3.3.1	Transmitters of all types and model. (for the measurement of Pressure, differential pressure, flow, level, etc.) including local indication (if applicable) (2 Nos. of each type and model)	1.00	SET
3.3.2	RTD's (1 no. of each type)	1.00	SET
3.3.3	Pressure gauges (1 no. of each range and type)	1.00	SET
3.3.4	Differential Pressure Gauges, (1 no. of each range and type)	1.00	SET
3.3.5	All types of Rota meters (1 no. of each range)	1.00	SET
3.3.6	Process Actuated Switch Devices -As applicable for this package, as per the following items		
3.3.6 (i)	Flow switches (1 no. of each range and type)	1.00	SET
3.3.6 (ii)	Solenoid Valves (2 nos. of each type, model and rating)	1.00	SET
3.3.7	Electric Actuators (1 no. of each type, class, size and model whichever is more.)	1.00	LOT
3.4	**Raw Water (Ash) Pumps**		
3.4.1	Impeller with nuts & washers	1.00	SET
3.4.2	Bearings for Line, Head and Impeller shafts	1.00	SET
3.4.3	Thrust Bearings of pump & drive	1.00	SET
3.4.4	Wearing rings – Impeller (if applicable)	1.00	SET
3.4.5	Wearing rings – Casing (if applicable)	1.00	SET
3.4.6	Gland, packing & gland assembly	1.00	SET
3.4.7	Impeller Shaft, line shaft and head shaft	1.00	SET
3.4.8	Shaft Sleeves	1.00	SET
3.4.9	Stuffing box	1.00	SET
3.4.10	Pump & Drive Coupling, bushes, pins with all fasteners & coupling guards (as applicable)	1.00	SET
3.4.11	All Gaskets	1.00	SET
3.4.12	Motor and Motor Bearings	1.00	SET
3.4.13	Line Shaft Couplings (if applicable)	1.00	SET

	TECHNICAL SPECIFICATION MISC. PUMPS (VERTICAL) 2X800 MW LARA STAGE-II & 2X800 SINGRAULI STAGE-III	PE-TS-508/512-100-W002 Rev. No. 00 Date : 14.08.25	
	BOQ SCHEDULE - 2X800MW LARA		
3.5	**Spares for Lubrication Water Pumps for Raw Water (Ash) Pumps**		
3.5.1	Impeller with nuts and other accessories	1.00	SET
3.5.2	Impeller Shaft with fasteners	1.00	SET
3.5.3	Shaft Sleeves	1.00	SET
3.5.4	Wearing rings – Impeller (if applicable)	1.00	SET
3.5.5	Wearing Rings – Casing (if applicable)	1.00	SET
3.5.6	Pump bearings	1.00	SET
3.5.7	Thrust bearings	1.00	SET
3.5.8	Pump & Drive Coupling compl. assy. & coupling Guards	1.00	SET
3.5.9	Pump to drive coupling bushes with fasteners	1.00	SET
3.5.10	Gland, Packing & Gland Assembly / Mech. seal as applicable	1.00	SET
3.5.11	Motor for Lubrication Water Pumps	1.00	Nos
3.6	**C&I Spares for Raw Water (Ash) Pumps & Lubrication System (If applicable)**		
3.6.1	Transmitters of all types and model. (for the measurement of Pressure, differential pressure, flow, level, etc.) including local indication (if applicable) (2 Nos. of each type and model.)	1.00	SET
3.6.2	Pressure gauges (1 no. of each range and type)	1.00	SET
3.6.3	Differential Pressure Gauges, (1 no. of each range and type)	1.00	SET
3.6.4	All types of Rota meters (1 no. of each range)	1.00	SET
3.6.5	Process Actuated Switch Devices -As applicable for this package, as per the following items		
3.6.5 (i)	Flow switches (1 no. of each range and type)	1.00	SET
3.6.5 (ii)	Solenoid Valves (2 nos. of each type, model and rating)	1.00	SET
3.6.6	Electric Actuators (1 no. of each type, class, size and model whichever is more.)	1.00	LOT
NOTE:			
1	One(1) set consists of quantity required for complete replacement for one(1) Pump of each type/size. Also the ‘set’ would include all components/hardware required to replace the item.		
2	Bidder shall not indicate “Not Applicable” against any of the spare (except for those items for which “if applicable” is specified). In case of not applicability, functionally equivalent spare to be mentioned with price in the relevant price schedules. Bidder shall not mention any remark other than price value in relevant price schedule.		

	TECHNICAL SPECIFICATION MISC. PUMPS (VERTICAL) 2X800 MW LARA STAGE-II & 2X800 SINGRAULI STAGE-III	PE-TS-508/512-100-W002
		Rev. No. 00
	BOQ SCHEDULE - 2X800 MW SINGRAULI	Date : 14.08.25

1.0	**Supply of Pumps and Motors:**	**UOM**	**QUANTITY**
1.1	**AUX. CT PUMPS**		
1.1.1	Pump	Nos.	4
1.1.2	Motor	Nos.	by BHEL
1.1.3	Forced Water Lubrication System	Set	1
1.1.4	Mandatory Spares (as per S.No. 3.0 below)	Lot	1
NOTE: Commissioning & Erection spares, special Tools & tackle and other accessories applicable as per Specification but not listed above shall be included in the price of pump/motor & shall be supplied with the pump/motor.			

2.0	**SITE SERVICES:**	**UOM**	**QUANTITY**
2.1	Installation Check at Site as per Specification		
2.1.1	Site Visit Charges	Nos. of Visits	4
2.1.2	Manday Charges at Site	Nos. of Mandays	16
2.2	PG Test of pumps at site as per Specification	Lot	1

NOTE:

1	Service charges at Sl.no 2.1.1 shall include to/fro travel expenses, medical and insurance.
2	Service Charges at Sl.no 2.1.2 shall include boarding/lodging, local conveyance or any other applicable charge for completion of site services. No. of mandays at site defined at Sl.no. 2.1.2 above shall be calculated on the basis of presence at site (travelling time/days is excluded).
3	Payment for Sl. No. 2.1 shall be done based on actual consumed site visits and mandays.

3.0	**Mandatory Spares for**	**UOM**	**QUANTITY**
3.1	**AUX. CT PUMPS**		
3.1.1	Impeller with nuts & washers	1.00	SET
3.1.2	Bearings for Line, Head and Impeller shafts	1.00	SET
3.1.3	Thrust Bearings of pump & drive	1.00	SET
3.1.4	Wearing rings – Impeller (if applicable)	1.00	SET
3.1.5	Wearing rings – Casing (if applicable)	1.00	SET
3.1.6	Gland, packing & gland assembly	1.00	SET
3.1.7	Impeller Shaft, line shaft and head shaft	1.00	SET
3.1.8	Shaft Sleeves	1.00	SET
3.1.9	Stuffing box	1.00	SET
3.1.10	Pump & Drive Coupling, bushes, pins with all fasteners & coupling guards (as applicable)	1.00	SET
3.1.11	All Gaskets	1.00	SET
3.1.12	Line Shaft Couplings (if applicable)	1.00	SET

	TECHNICAL SPECIFICATION MISC. PUMPS (VERTICAL) 2X800 MW LARA STAGE-II & 2X800 SINGRAULI STAGE-III	PE-TS-508/512-100-W002 Rev. No. 00	
	BOQ SCHEDULE - 2X800 MW SINGRAULI	Date : 14.08.25	
3.2	**Spares for Lubrication Water Pumps for AUX. CT PUMPS**		
3.2.1	Impeller with nuts & other accessories	1.00	SET
3.2.2	Impeller Shaft with fasteners	1.00	SET
3.2.3	Shaft Sleeves	1.00	SET
3.2.4	Wearing rings – Impeller (if applicable)	1.00	SET
3.2.5	Wearing Rings – Casing (if applicable)	1.00	SET
3.2.6	Pump bearings	1.00	SET
3.2.7	Thrust bearings	1.00	SET
3.2.8	Pump & Drive Coupling compl. assy. & coupling Guards	1.00	SET
3.2.9	Pump to drive coupling bushes with fasteners	1.00	SET
3.2.10	Gland, Packing & Gland Assembly / Mech. seal as applicable	1.00	SET
3.2.11	Motor for Lubrication Water Pumps	1.00	Nos
3.3	**C&I Spares for AUX. CT PUMPS & Lubrication System**		
3.3.1	Transmitters of all types and model. (for the measurement of Pressure, differential pressure, flow, level, etc.) including local indication (if applicable) (2 Nos. of each type and model)	1.00	LOT
3.3.2	RTD's (1 no. of each type)	1.00	LOT
3.3.3	Pressure gauges (1 no. of each range and type)	1.00	LOT
3.3.4	Differential Pressure Gauges, (1 no. of each range and type)	1.00	LOT
3.3.5	Flow gauges excluding Rota meters (if applicable) (1 no. of each range and type)	1.00	LOT
3.3.6	All types of Rota meters (if applicable) (1 no. of each range)	1.00	LOT
3.3.7	Process Actuated Switch Devices -As applicable		
3.3.7 (i)	Flow switches (1 no. of each range and type)	1.00	LOT
3.3.7 (ii)	Solenoid Valves (2 nos. of each type, model and rating)	1.00	LOT
3.3.7 (iii)	Limit Switches (for Pneumatic Valves and Manual valves) (2 nos. of each type)	1.00	LOT
3.3.8 (i)	Electric Actuators (1 no. of each type, class, size and model whichever is more.)	1.00	LOT
3.3.8 (ii)	Electronic PCB of all types (10% of each type & model)	1.00	LOT
3.3.8 (iii)	Absolute Encoder (replaceable part) (5% of each type & model)	1.00	LOT
3.3.8 (iv)	Electronic Torque sensor (5% of each type & model)	1.00	LOT
NOTE:			

	TECHNICAL SPECIFICATION MISC. PUMPS (VERTICAL) 2X800 MW LARA STAGE-II & 2X800 SINGRAULI STAGE-III	PE-TS-508/512-100-W002
		Rev. No. 00
	BOQ SCHEDULE - 2X800 MW SINGRAULI	Date : 14.08.25
1	One(1) set consists of quantity required for complete replacement for one(1) Pump of each type/size. Also the 'set' would include all components/hardware required to replace the item.	
2	Bidder shall not indicate "Not Applicable" against any of the spare (except for those items for which "if applicable" is specified). In case of not applicability, functionally equivalent spare to be mentioned with price in the relevant price schedules. Bidder shall not mention any remark other than price value in relevant price schedule.	

DOCUMENTATION REQUIREMENT

DRAWINGS & DOCUMENTS TO BE SUBMITTED BY ALL THE BIDDERS ALONG WITH THE BID

Sl. No.	DOCUMENT TITLE
1	PQR CREDENTIALS (APPLICABLE AS PER NIT)
2	COMPLIANCE CERTIFICATE (Duly Signed and Stamped)
3	GA DRAWINGS OF PUMP & MOTOR SET INDICATING PUMP OUTLINE DIMENSIONS, MINIMUM SUBMERGENCE REQUIRED, SUMP CLEARANCES - SIDE, BACK & BOTTOM, MINIMUM RECOMMENDED CRANE CAPACITY and CIVIL LOAD DETAILS (Only for Reference and not for Comment/Approval)
4	Data for Drive Motor which is not in bidder's scope of supply: Load torque speed curves of the pumps, selected motor rating, rpm, GD2 of driven equipment.
5	SCHEDULE OF PERFORMANCE GUARANTEES (Duly Signed & Stamped and as per the format provided with Specification)

DRAWINGS & DOCUMENTS TO BE SUBMITTED BY SUCCESSFUL BIDDER AFTER AWARD OF CONTRACT ALONG WITH SUBMISSION SCHEDULE

Sl. No.	DOCUMENT TITLE	SUBMISSION SCHEDULE
1	TDS AND PERFORMACE CURVES- MISC. PUMPS (V)	Rev-00 to be submitted within 25 days of LOI/PO date.
2	GENERAL ARRANGEMENT AND CROSS SECTIONAL-MISC. PUMPS (V)	
3	TDS AND CURVES OF MOTORS FOR MISC. PUMPS (V)	
4	QP-MISC PUMPS (V)	
5	QP- MOTORS	
6	MOTOR TYPE TEST DOC - If Applicable	Rev-00 to be submitted within 15 days of approval of documents at S.No. 3 & 5 above.
7	O & M MANUAL - MISC PUMPS (V)	Rev-00 to be submitted within 15 days of approval of above documents.
8	PG TEST PROCEDURE - MISC PUMPS (V) - If Applicable	
9	PROCEDURE FOR SUMP MODEL STUDY - If Applicable	Within One (1) month of LOI/PO date.
10	FINAL RECOMMENDATION REPORT OF SUMP MODEL STUDY - If Applicable	Within One (1) month of approval of documents at S.No. 9 above.
BHEL/Customer comments/approval and Vendor Re-submission schedule		

BHEL comments on First Submission	Within 10 days of Vendor submission.
BHEL/Customer comments/approval on Revised Submission	Within 18 days of Vendor submission.
Vendor Re-submission	Within 7 days of BHEL / Customer comments.

Important Instructions for Drawings & Documents to be submitted after award of Contract

1	Fully dimensioned outline general arrangement drawings of the pump and motor assembly (including Forced Water Lubrication System) 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.
2	The bidder shall also submit a write-up describing clearly the procedure of raising/lowering of the pump assembly (multi-piece column pipe and shaft assembly) piece by piece without any difficulty the pump.
3	Characteristic curves of pumps showing the following to be submitted: a) Flow Vs Head b) Flow Vs Power c) Flow Vs Efficiency d) Flow Vs NPSHR/ minimum submergence

DRAWINGS & DOCUMENTS TO BE SUBMITTED AS FINAL/AS-BUILT DOCUMENT

Sl. No.	DOCUMENT TITLE
1	APPROVED DOCUMENTS
2	O&M MANUAL
3	ALL TEST CERTIFICATES / REPORTS
4	DRAWINGS OF COMPONENTS AND DETAILS AS DEEMED NECESSARY.
5	STORAGE INSTRUCTIONS

PRE QUALIFICATION REQUIREMENT (TECHNICAL)

FORM NO. PEM 6100-0

	PRE - QUALIFYING REQUIREMENTS (TECHNICAL)	TECHNICAL SPECIFICATION NO- PE-TS-508/512-100-W002, Rev-00 TECHNICAL PQR NO. PE-PQ-508/512-100-W114 REV NO.-00 DATED: 14.08.25
		STANDARD PQR NO: PE-PQ-STD-100-N113 REVISION NO: 04 DATE: 07.02.2020
		SHEET: 1 of 2

ENQUIRY NO:

PROJECT: 2X800 MW LARA STAGE-II & 2X800 SINGRAULI STAGE-III

PACKAGE: MISC. PUMPS (VERTICAL)

1. The bidder should have designed, manufactured, tested, inspected & supplied the Vertical Centrifugal pumps for water application with minimum rated flow of 2100 m3/hr, which have been successfully in use for at least 1 year in two different thermal power plants or similar industry/ application and bidder is in business of Vertical centrifugal pumps for water application on continuous basis.

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

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

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

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

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

      OR

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

      OR

      iii. Satisfactory Performance feedback certificates from End Customer (Owner) (in English) for one successfully executed contract which have been successfully in use for atleast one year indicating salient features like year of commissioning of Vertical centrifugal pumps for

water application, rating of project, flow of Vertical centrifugal pumps for water application, project name etc., date of issue of certificate and name/ designation of the certificate issuer for power plant/similar application industry. The time duration of Satisfactory performance completion should be before the date of subject Enquiry/NIT.

AND

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

Notes: -

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

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

a. Tax Invoice.

b. Site receipt/Receipted LR.

c. Customer's material dispatch clearance certificate.

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

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

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

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

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

N7. Attached annexure-2 to be filled by the bidders on quality and general terms. Requisite documents (e.g. factory registration certificate, R&D setup details, etc) asked in the Annexure-2, shall also be attached as annexure-F2.1 to F2.17 along with the filled response.

EXPERIENCE LIST

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

Annexure-2

CORPORATE QUALITY ASSURANCE
SUB-VENDOR QUESTIONNAIRE

i.	***Item/Scope of Sub-contracting***	
ii.	***Address of the registered office***	***Details of Contact Person (Name, Designation, Mobile, Email)***
iii.	***Name and Address of the proposed Sub-vendor's works where item is being manufactured***	***Details of Contact Person: (Name, Designation, Mobile, Email)***
iv.	***Annual Production Capacity for proposed item/scope of sub-contracting***	
v.	***Annual production for last 3 years for proposed item/scope of sub-contracting***	
vi.	***Details of proposed works***	
1.	***Year of establishment of present works***	
2.	***Year of commencement of manufacturing at above works***	
3.	***Details of change in Works address in past (if any)***	
4.	***Total Area***	
	Covered Area	
5.	***Factory Registration Certificate***	***Details attached at Annexure – F2.1***
6.	***Design/ Research & development set-up (No. of manpower, their qualification, machines & tools employed etc.)***	***Applicable / Not applicable if manufacturing is as per Main Contractor/purchaser design) Details attached at Annexure – F2.2 (if applicable)***
7.	***Overall organization Chart with Manpower Details (Design/Manufacturing/Quality etc)***	***Details attached at Annexure – F2.3***
8.	***After sales service set up in India, in case of foreign sub-vendor (Location, Contact Person, Contact details etc.)***	***Applicable / Not applicable Details attached at Annexure – F2.4***
9.	***Manufacturing process execution plan with flow chart indicating various stages of manufacturing from raw material to finished product including outsourced process, if any***	***Details attached at Annexure – F2.5***
10.	***Sources of Raw Material/Major Bought Out Item***	***Details attached at Annexure – F2.6***
11.	***Quality Control exercised during receipt of raw material/BOI, in-process , Final Testing, packing***	***Details attached at Annexure – F2.7***

CORPORATE QUALITY ASSURANCE
SUB-VENDOR QUESTIONNAIRE

12.	***Manufacturing facilities*** ***(List of machines, special process facilities, material handling etc.)***	***Details attached at Annexure – F2.8***
13.	***Testing facilities*** ***(List of testing equipment)***	***Details attached at Annexure – F2.9***
14.	***If manufacturing process involves fabrication then-***	***Applicable / Not applicable***
	List of qualified Welders	***Details attached at Annexure – F2.10***
	List of qualified NDT personnel with area of specialization	***(if applicable)***
15.	***List of out-sourced manufacturing processes with Sub-Vendors' names & addresses***	***Applicable / Not applicable*** ***Details attached at Annexure. –F2.11*** ***(if applicable)***
16.	***Supply reference list including recent supplies***	***Details attached at Annexure – F2.12*** ***(as per format given below)***

Project/ package	*Customer Name*	*Supplied Item (Type/Rating/Model /Capacity/Size etc)*	*PO ref no/date*	*Supplied Quantity*	*Date of Supply*

17.	***Product satisfactory performance feedback letter/certificates/End User Feedback***	***Attached at annexure - F2.13***
18.	***Summary of Type Test Report (Type Test Details, Report No, Agency, Date of testing) for the proposed product*** ***(similar or higher rating)*** ***Note:- Reports need not to be submitted***	***Applicable / Not applicable*** ***Details attached at Annexure – F2.14*** ***(if applicable)***
19.	***Statutory / mandatory certification for the proposed product***	***Applicable / Not applicable*** ***Details attached at Annexure – F2.15*** ***(if applicable)***
20.	***Copy of ISO 9001 certificate*** ***(if available)***	***Attached at Annexure – F2.16***
21.	***Product technical catalogues for proposed item (if available)***	***Details attached at Annexure – F2.17***

Name:		***Desig:***		***Sign:***		***Date:***	

Company's Seal/Stamp:-

COMPLIANCE CERTIFICATE	
1	It is hereby confirm that the complete technical specification has been read, understood. We confirm compliance to the tender specification including any pre-bid clarifications and amendments, without any deviation.
2	It is hereby declared that any technical submittals which was not specifically asked for in NIT shall be considered withdrawn.

Signature of authorised Representative

Name and Designation :

Name & Address of the Bidder

Date