SCHEDULE OF PRICES - MISC PUMPS HORIZONTAL

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)	FREIGHT %AGE OF TOTAL EX WORKS	FREIGHT AMT (INR)	TOTAL EX-WORKS + FREIGHT (INR)	GST RATE	GST AMT	TOTAL F.O.R. PRICE (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 & supervision of replacement of gland packing with Mechanical Seal arrangement (as applicable) at site, PG Test at site and any other services, etc. as per specification PE-TS-508-100-W001, REV-00 for Misc. Pumps Horizontal of 2X800 MW LARA STPP STAGE-II.										
1.0	**Pumps and Motors (Horizontal Pumps):**										
	(i) DMCW TG-AUX'S PUMPS										
	Pump price:	Nos.	6								
	Motor price:	Nos.	BHEL Scope								
	Suction Strainer:	Nos.	6								
	Mandatory Spares (as per Annexure -A)	Lot	1								
	(ii) DMCW SG-AUX'S PUMPS										
	Pump price:	Nos.	6								
	Motor price:	Nos.	BHEL Scope								
	Suction Strainer:	Nos.	6								
	Mandatory Spares (as per Annexure -A)	Lot	1								
	(iii) ACW PUMPS										
	Pump price:	Nos.	6								
	Motor price:	Nos.	BHEL Scope								
	Mandatory Spares (as per Annexure -A)	Lot	1								
	(iv) DM MAKE-UP PUMPS										
	Pump price:	Nos.	3								
	Motor price:	Nos.	3								
	Suction Strainer:	Nos.	3								
	Mandatory Spares (as per Annexure -A)	Lot	1								
	(v) BOILER FILL PUMPS										
	Pump price:	Nos.	2								
	Motor price:	Nos.	2								
	Suction Strainer:	Nos.	2								
	Mandatory Spares (as per Annexure -A)	Lot	1								
	(vi) CONDENSATE TRANSFER PUMPS										
	Pump price:	Nos.	2								
	Motor price:	Nos.	2								
	Suction Strainer:	Nos.	2								
	Mandatory Spares (as per Annexure -A)	Lot	1								
	(vii) CW MAKE UP PUMPS										
	Pump price:	Nos.	3								
	Motor price:	Nos.	3								
	Mandatory Spares (as per Annexure -A)	Lot	1								
	(viii) SERVICE WATER PUMPS										
	Pump price:	Nos.	3								
	Motor price:	Nos.	3								

SCHEDULE OF PRICES - MISC PUMPS HORIZONTAL

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)	FREIGHT %AGE OF TOTAL EX WORKS	FREIGHT AMT (INR)	TOTAL EX-WORKS + FREIGHT (INR)	GST RATE	GST AMT	TOTAL F.O.R. PRICE (INR)
	Mandatory Spares (as per Annexure -A)	Lot	1								
	(ix) **HVAC MAKE UP PUMPS**										
	Pump price:	Nos.	2								
	Motor price:	Nos.	2								
	Mandatory Spares (as per Annexure -A)	Lot	1								
	(x) **APH/ ESP WASH PUMPS**										
	Pump price:	Nos.	2								
	Motor price:	Nos.	BHEL Scope								
	Mandatory Spares (as per Annexure -A)	Lot	1								
	(xi) **FGD GYPSUM WASH PUMPS**										
	Pump price:	Nos.	2								
	Motor price:	Nos.	2								
	Mandatory Spares (as per Annexure -A)	Lot	1								
	(xii) **FGD PROCESS WATER PUMPS**										
	Pump price:	Nos.	2								
	Motor price:	Nos.	2								
	Mandatory Spares (as per Annexure -A)	Lot	1								
2.0	**SITE SERVICES:**										
2.1	**Installation Check (For all Pumps) & Supervision for replacement of Gland packing with Mechanical Seal (for DMCW TG-Aux's Pumps, DMCW SG-Aux's Pumps, DM Make-up Pumps, Boiler Fill Pumps and Condensate Transfer Pumps) at Site as per Specification**					NOT APPLICABLE					
2.1.1	Site Visit Charges	Nos. of Visits	30								
2.1.2	Manday Charges at Site	Nos. of Mandays	90								
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. In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer
spares applicable to offered design with quantities as specified in the Technical specification/NIT.

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 (HORIZONTAL)
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)	FREIGHT %AGE OF TOTAL EX WORKS	FREIGHT AMT (INR)	TOTAL EX-WORKS + FREIGHT (INR)	GST RATE	GST AMT	TOTAL F.O.R. PRICE (INR)
1.0	**MANDATORY SPARES PRICES-MISC PUMPS (HORIZONTAL)**											
1.1	DMCW TG-AUX'S PUMPS	**1.1.1**	Shaft Sleeve (DE & NDE)	2 sets								
		1.1.2	Shaft	1 set								
		1.1.3	Impeller	1 set								
		1.1.4	Casing & impeller Wearing Ring	2 sets								
		1.1.5	Bearings for Pumps	2 sets								
		1.1.6	Thrust Bearings (if applicable)	2 sets								
		1.1.7	Sleeve nuts and O-rings	2 sets								
		1.1.8	Fasteners	1 set								
		1.1.9	Complete Coupling (Pump & Motor)	1 set								
		1.1.10	Mechanical seal (both DE and NDE) if applicable	2 sets								
		1.1.11	RTD's (1 no. of each type)	1 set								
1.2	DMCW SG-AUX'S PUMPS	**1.2.1**	Shaft Sleeve (DE & NDE)	2 sets								
		1.2.2	Shaft	1 set								
		1.2.3	Impeller	1 set								
		1.2.4	Casing & impeller Wearing Ring	2 sets								
		1.2.5	Bearings for Pumps	2 sets								
		1.2.6	Thrust Bearings (if applicable)	2 sets								
		1.2.7	Sleeve nuts and O-rings	2 sets								
		1.2.8	Fasteners	1 set								
		1.2.9	Complete Coupling (Pump & Motor)	1 set								
		1.2.10	Mechanical seal (both DE and NDE) if applicable	2 sets								
		1.2.11	RTD's (1 no. of each type)	1 set								
1.3	ACW PUMPS	**1.3.1**	Shaft Sleeve (DE & NDE)	2 sets								
		1.3.2	Shaft	1 set								
		1.3.3	Impeller	1 set								
		1.3.4	Casing & impeller Wearing Ring	2 sets								
		1.3.5	Bearings for Pumps	2 sets								
		1.3.6	Thrust Bearings (if applicable)	2 sets								
		1.3.7	Sleeve nuts and O-rings	2 sets								
		1.3.8	Fasteners	1 set								
		1.3.9	Complete Coupling (Pump & Motor)	1 set								
		1.3.10	Mechanical seal (both DE and NDE) if applicable	2 sets								
		1.3.11	RTD's (1 no. of each type)	1 set								

SCHEDULE OF PRICES -ANNEXURE-A
MANDATORY SPARES OF MISC. PUMPS (HORIZONTAL)
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)	FREIGHT %AGE OF TOTAL EX WORKS	FREIGHT AMT (INR)	TOTAL EX-WORKS + FREIGHT (INR)	GST RATE	GST AMT	TOTAL F.O.R. PRICE (INR)
1.4	DM MAKE-UP PUMPS	**1.4.1**	Impeller for each type	1 set								
		1.4.2	Wearing rings – Impeller for each type (if applicable)	1 set								
		1.4.3	Wearing rings – Casing for each type (if applicable)	1 set								
		1.4.4	Shaft for each type	1 set								
		1.4.5	Shaft Sleeves for each type	1 set								
		1.4.6	Stuffing box for each type	1 set								
		1.4.7	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards	1 set								
		1.4.8	Pump bearings for each type	1 set								
		1.4.9	Gland, Packing & Gland Assembly for each type	1 set								
		1.4.10	Motor and Motor Bearings of each type	1 set								
1.5	BOILER FILL PUMPS	**1.5.1**	Impeller for each type	1 set								
		1.5.2	Wearing rings – Impeller for each type (if applicable)	1 set								
		1.5.3	Wearing rings – Casing for each type (if applicable)	1 set								
		1.5.4	Shaft for each type	1 set								
		1.5.5	Shaft Sleeves for each type	1 set								
		1.5.6	Stuffing box for each type	1 set								
		1.5.7	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards	1 set								
		1.5.8	Pump bearings for each type	1 set								
		1.5.9	Gland, Packing & Gland Assembly for each type	1 set								
		1.5.10	Motor and Motor Bearings of each type	1 set								
1.6	CONDENSATE TRANSFER PUMPS	**1.6.1**	Impeller for each type	1 set								
		1.6.2	Wearing rings – Impeller for each type (if applicable)	1 set								
		1.6.3	Wearing rings – Casing for each type (if applicable)	1 set								
		1.6.4	Shaft for each type	1 set								
		1.6.5	Shaft Sleeves for each type	1 set								
		1.6.6	Stuffing box for each type	1 set								
		1.6.7	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards	1 set								
		1.6.8	Pump bearings for each type	1 set								

SCHEDULE OF PRICES -ANNEXURE-A
MANDATORY SPARES OF MISC. PUMPS (HORIZONTAL)
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)	FREIGHT %AGE OF TOTAL EX WORKS	FREIGHT AMT (INR)	TOTAL EX-WORKS + FREIGHT (INR)	GST RATE	GST AMT	TOTAL F.O.R. PRICE (INR)
		1.6.9	Gland, Packing & Gland Assembly for each type	1 set								
		1.6.10	Motor and Motor Bearings of each type	1 set								
1.7	CW MAKE UP PUMPS	**1.7.1**	Impeller for each type	1 set								
		1.7.2	Wearing rings – Impeller for each type (if applicable)	1 set								
		1.7.3	Wearing rings – Casing for each type (if applicable)	1 set								
		1.7.4	Shaft for each type	1 set								
		1.7.5	Shaft Sleeves for each type	1 set								
		1.7.6	Stuffing box for each type	1 set								
		1.7.7	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards	1 set								
		1.7.8	Pump bearings for each type	1 set								
		1.7.9	Gland, Packing & Gland Assembly for each type	1 set								
		1.7.10	Motor and Motor Bearings of each type	1 set								
1.8	SERVICE WATER PUMPS	**1.8.1**	Impeller for each type	1 set								
		1.8.2	Wearing rings – Impeller for each type (if applicable)	1 set								
		1.8.3	Wearing rings – Casing for each type (if applicable)	1 set								
		1.8.4	Shaft for each type	1 set								
		1.8.5	Shaft Sleeves for each type	1 set								
		1.8.6	Stuffing box for each type	1 set								
		1.8.7	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards	1 set								
		1.8.8	Pump bearings for each type	1 set								
		1.8.9	Gland, Packing & Gland Assembly for each type	1 set								
		1.8.10	Motor and Motor Bearings of each type	1 set								
1.9	HVAC MAKE UP	**1.9.1**	Impeller for each type	1 set								
		1.9.2	Wearing rings – Impeller for each type (if applicable)	1 set								
		1.9.3	Wearing rings – Casing for each type (if applicable)	1 set								
		1.9.4	Shaft for each type	1 set								
		1.9.5	Shaft Sleeves for each type	1 set								
		1.9.6	Stuffing box for each type	1 set								

SCHEDULE OF PRICES -ANNEXURE-A
MANDATORY SPARES OF MISC. PUMPS (HORIZONTAL)
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)	FREIGHT %AGE OF TOTAL EX WORKS	FREIGHT AMT (INR)	TOTAL EX-WORKS + FREIGHT (INR)	GST RATE	GST AMT	TOTAL F.O.R. PRICE (INR)
	PUMPS	**1.9.7**	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards	1 set								
		1.9.8	Pump bearings for each type	1 set								
		1.9.9	Gland, Packing & Gland Assembly for each type	1 set								
		1.9.10	Motor and Motor Bearings of each type	1 set								
1.10	APH/ ESP WASH PUMPS	**1.10.1**	Impeller for each type	1 set								
		1.10.2	Wearing rings – Impeller for each type (if applicable)	1 set								
		1.10.3	Wearing rings – Casing for each type (if applicable)	1 set								
		1.10.4	Shaft for each type	1 set								
		1.10.5	Shaft Sleeves for each type	1 set								
		1.10.6	Stuffing box for each type	1 set								
		1.10.7	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards	1 set								
		1.10.8	Pump bearings for each type	1 set								
		1.10.9	Gland, Packing & Gland Assembly for each type	1 set								
		1.10.12	RTD's (1 no. of each type)	1 set								
1.11	FGD GYPSUM WASH PUMPS	**1.11.1**	Impeller for each type	1 set								
		1.11.2	Wearing rings – Impeller for each type (if applicable)	1 set								
		1.11.3	Wearing rings – Casing for each type (if applicable)	1 set								
		1.11.4	Shaft for each type	1 set								
		1.11.5	Shaft Sleeves for each type	1 set								
		1.11.6	Stuffing box for each type	1 set								
		1.11.7	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards	1 set								
		1.11.8	Pump bearings for each type	1 set								
		1.11.9	Gland, Packing & Gland Assembly for each type	1 set								
		1.11.10	Motor and Motor Bearings of each type	1 set								
		1.11.1	Impeller for each type	1 set								
		1.11.2	Wearing rings – Impeller for each type (if applicable)	1 set								
		1.11.3	Wearing rings – Casing for each type (if applicable)	1 set								

SCHEDULE OF PRICES -ANNEXURE-A
MANDATORY SPARES OF MISC. PUMPS (HORIZONTAL)
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)	FREIGHT %AGE OF TOTAL EX WORKS	FREIGHT AMT (INR)	TOTAL EX-WORKS + FREIGHT (INR)	GST RATE	GST AMT	TOTAL F.O.R. PRICE (INR)
1.12	FGD PROCESS WATER PUMPS	**1.11.4**	Shaft for each type	1 set								
		1.11.5	Shaft Sleeves for each type	1 set								
		1.11.6	Stuffing box for each type	1 set								
		1.11.7	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards	1 set								
		1.11.8	Pump bearings for each type	1 set								
		1.11.9	Gland, Packing & Gland Assembly for each type	1 set								
		1.11.10	Motor and Motor Bearings of each type	1 set								

2X800 MW LARA STPP STAGE-II

Customer: NTPC

TECHNICAL SPECIFICATION
FOR
MISC. PUMPS (HORIZONTAL)

SPECIFICATION No. **PE-TS-508-100-W001**

REV NO. 00

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

INDEX

बी एच ई एल BHEL	TECHNICAL SPECIFICATION MISC. PUMPS (HORIZONTAL) 2X800 MW LARA STPP STAGE-II	PE-TS-508-100-W001 Rev. No. 00 Date : 25.04.25

PROJECT INFORMATION

SL.NO	DESCRIPTION	DETAILS
1	**METEOROLOGICAL DATA**	
1.1	MAXIMUM TEMPERATURE	48.3 Deg C
1.2	MINIMUM TEMPERATURE	6.4 Deg C
1.3	MAXIMUM RELATIVE HUMIDITY	0.84
1.4	MINIMUM RELATIVE HUMIDITY	0.22
1.5	AVERAGE ANNUAL RAINFALL	1429.3 mm
1.6	SEISMIC ZONE (AS PER IS 1893)	Zone: IV as defined in IS:1893-2002
1.7	HEIGHT ABOVE MSL	(+) 207 Meter above Mean Sea Level
1.8	BASIC WIND SPEED (AS PER IS 875)	44 m/s
2	**ELECTRICAL DATA**	
2.1	AMBIENT TEMPERATURE FOR DESIGN OF ELECTRICAL EQUIPMENT	50 Deg C
2.2	RATED FREQUENCY	refer part A of spec.
2.3	FREQUENCY VARIATION	
2.4	AC VOLTAGE	
2.5	AC VOLTAGE VARIATION	
2.8	FAULT LEVEL (KA/SEC)	

	TECHNICAL SPECIFICATION MISC. PUMPS (HORIZONTAL) 2X800 MW LARA STPP STAGE-II	PE-TS-508-100-W001 Rev. No. 00 Date : 25.04.25

	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 BHEL/owner 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. 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 operation of pumps and drives to be provided without any cost implication to BHEL.
11	The pumps shall be capable of running over the entire range of NPSH conditions required without any noise, vibration or cavitations.
12	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 stipulted in TECHNICAL DATA - PART - A.
13	The pumps shall be capable of starting with discharge valve fully open and close condition.
14	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.

15	Components of identical pumps shall be interchangeable.
16	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.
17	Wherever Staineless (SS) material is coming in contact with non SS material, suitable isolation (rubber etc.) shall be provided to avoid galvanic corrosion.
	CASING
18	Pump Casing shall be provided with a connection for suction and discharge pressure Gauge as standard feature.
19	Pump Suction/Discharge nozzles are capable of withstanding external reactions not less than those specified in API-610.
20	In case where an expansion joint is located at pump discharge, the pump assembly will be subjected to an additional thrust which will be transmitted to the foundation. This additional thrust shall be taken into the consideration of pump design.
	IMPELLER
21	The Impeller assembly shall be dynamically balanced and designed with critical speed substantially above the operating speed.
	WEARING RING
22	Replaceable type wearing rings (as applicable) shall be furnished to prevent damage to impeller and casing.
	SHAFT
23	Shaft size selected must take into consideration the critical speed as specified in API-610. The critical speed shall be at least 30% higher than the rated speed. 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 SLEEVE
24	Renewable type fine finished shaft sleeves shall be provided at the stuffing boxes/ mechanical seals.
25	Length of the shaft sleeves shall be extended beyond the outer faces of gland packing or seal end plate so as to distinguish between the leakage past Shaft and shaft sleeve and that past the seals/glands.
26	Shaft sleeves to be properly fastened to the shaft to prevent any leakage or loosening. Shaft sleeve assembly should ensure concentric rotation.
27	In case, shaft sleeve is threaded, a water slinger to be provided on the Pump Shaft to avoid ingress of leaked water (if any due to failure of sealing arrangement for shaft sleeve) to Bearing.
	BEARING
28	Bearings to be easily accessible without disturbing the pump assembly.

29	In case of axial split casing Multistage pumps, minimum factor of safety of '2' times shall be considered for bearing capacity selection and pump design.
30	Heavy-duty ball/roller bearing to be provided to take care of the radial loads.
31	Adequate Hydraulic pressure balancing device or Thrust Bearing to be provided to take care of the axial loads.
32	A drain to be provided at the bottom of each bearing housing.
33	Provision on Bearing for mounting temperature measuring instruments to be provided.
	STUFFING BOX
34	Stuffing box to be designed for replacement of packing without removing any part other than the gland.
	MECHANICAL SEAL
35	For applicable pumps, only Cartridge Type Mechanical seals shall be provided and should be suitable for the given water quality.
36	If water handled (based upon the water quality given with Specification) by pump is dirty/ not suitable for lubrication/ cooling of Bearing/Stuffing Box/Seal, the bidder shall provide requisite strainer/ filters, tanks, motorized valves, etc. after the tap off for the required service, the arrangement provided shall be subject to BHEL/Customer approval.
	COUPLING
37	The pump and motor shafts shall be connected with adequately sized flexible coupling of proven design (pin-bush or spacer type) to facilitate dismantling of the pump without disturbing the motor. Necessary coupling guard shall be provided.
38	No. of coupling holes for joining coupling hubs shall be even in number and preferably in multiples of four.
	SUCTION STRAINER
39	Suction Strainer to be provided along with Pump as specified in TECHNICAL DATA - PART - A. Counter Flanges, Gaskets And Fasteners also be provided along with each Strainer.
40	**Instructions for HT/LT Motors supplied by BHEL as free issue (with scope mentioned in TECHNICAL DATA - PART - A):**
40.1	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.

40.2	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.
41	**SITE SERVICES:**
41.2	Pumps with Mechanical seal shall be supplied with gland packing arrangement initially to site and gland packing arrangement shall be replaced by vendor with mechanical seal arrangement at site after commissioning of the pumps with gland packing. Loose Mechanical seal shall be dispatched along with main supply. Shaft sleeve and any other item required for replacement of gland packing with Mechnaical seal and for satisfactory operation of Mechanical seal after replacement at site shall be provided by the pump supplier without any cost implication to BHEL.
41.2	The pumps erected by BHEL/Customer 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.
41.3	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.
42	**Instructions for Mandatory Spare:**
42.1	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.
42.2	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.
42.3	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.
42.4	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.
42.5	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.

43	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.
44	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	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.
2	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.
3	Bidder to provide RTD for Pump Bearing & winding Temperature Measurement for HT drives.
4	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.
5	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.
6	For all profibus devices GSD/DD and DTM files are to be provided for configuration/ testing in the DDCMIS for proper interfacing and diagnostics.
7	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.
8	**TYPE TEST GENERAL REQUIREMENT**
8.1	Submission of type test results and certificate shall be acceptable provided:
8.1.1	The same has been carried out by the Bidder/ sub-vendor on exactly the same model /rating of equipment.

8.1.2	There has been no change in the components from the offered equipment & tested equipment.
8.1.3	The test has been carried out as per the latest standards alongwith amendments as on the date of Bid opening.
8.2	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.
8.3	The schedule of conduction of type tests/ submission of reports shall be submitted and finalized during pre-award discussion.
8.4	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.

SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL

1.0 Scope for supply, and erection & commissioning of various equipment forming part of electrical system for this package shall be as per Annexure–I [Scope of Work (Electrical)].

2.0 Make of all electrical equipment/ items supplied shall be reputed make. Same shall be subject to approval of BHEL/customer after award of contract without any commercial implications. Tentative make list of various Electrical items (Motors/ lugs/glands) is attached.

3.0 All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.

4.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

4.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/ quality assurance requirements stipulated.

4.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

5.0 LIST OF ENCLOSURES

5.1 Electrical scope between BHEL & vendor (Annexure-I).
5.2 Technical specification - Motors (Annexure-II).
5.3 Datasheets –Motor (Annexure-III)
5.4 Quality Plan for motors. (Annexure-IV)
5.5 Load data format (Annexure-V).
5.6 Explanatory note for Cable routing & Cable schedule format (Annexure-VI)
5.7 Tentative make list for electrical items (motor, lugs, glands) (Annexure-VII)
5.8 Tentative list of cable sizes (Annexure-VIII)

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				

बी एच ई एल BHEL	TECHNICAL SPECIFICATION MISC. PUMPS (HORIZONTAL) 2X800 MW LARA STPP STAGE-II	PE-TS-508-100-W001 Rev. No. 00 Date : 25.04.25

CHECKLIST FOR INSTALLATION CHECK OF THE HORIZONTAL PUMP AT SITE

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

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

S. No.	ACTIVITY DESCRIPTION	OBSERVATION	REMARKS (IF ANY)
1	Relevant Engineering data like General Arrangement Drawing & Cross Sectional Drawing is available with site engineer for reference	Yes/No	
2	All components are available as per packing list or Approved Documents	Yes/No	
3	Condition of Pump components	OK/Not OK	
4	Pump foundation dimensions as per GA drawing (List out deviations if any)	OK/Not OK	
5	Suction & discharge piping as per GA drawing and pump is free from piping strains.	Yes/No	
6	Leveling & Center line matching of base plate	OK/Not OK	
7	Grouting of base plate- Tightness of foundation bolts to be checked	OK/Not OK	
8	Is there any need of inserting shims under motor, if yes then total thickness of shims provided	Yes/No mm	
9	Is the pump shaft free to rotate	Yes/No	
10	Bearings are properly Lubricated (Re-greasing of Bearings to be checked)	Yes/No	
11	Cooling/Flushing Connections provided for Packing Box/Mech. Seal Assembly	Yes/No	
12	Radial run out between pump & motor shafts at coupling	mm	
13	Tightness of bolts between pump-base plate and motor-base plate	OK/Not OK	
14	No load test of motor performed (As per Pump/Motor Manufacturer Recommendation)	Yes/No	
	If yes then Vibration levels at Drive end of Motor	A- V- H-	

15	Fitment of coupling halves on pump & motor shafts with respective hardwares & key	Ok/Not OK	
16	Key Slot / Notch for VMS available as per GA Drawing	Yes/No	
17	Any abnormal observation at this stage. If yes, then specify, trace out the cause & correct it.	Yes/No	
18	Any abnormal observation during initial trial run of the pumping set, If yes, then specify, trace out the cause & correct it	Yes/No	
19	Vibration level at Drive end of pump	A- V- H-	
20	Vibration Level at Non Drive End of pump	A- V- H-	
21	Temperature of bearings after initial trial run of one hour (a). At drive end (b). At Non drive end	 °C °C	
22	Max Stabilized temperature of bearings (a). At drive end (b). At non drive end	 °C °C °C	
23	Observed Noise Level at 1meter distance from the Pump	dbA	
24	Amount of leakage through Gland packing	Permissible/Not Permissible	
25	Mechanical Seal available at Site (for applicable Pumps only)	Yes/No	
ADDITIONAL REMARKS/OBSERVATION (IF ANY) 1. 2. 3.			
Pump Vendor Service Engineer Name Designation Sign & Date		BHEL Site Engineer Name Designation Sign & Date	End Customer (If Required) Name Designation Sign & Date

Annexure-1

HORIZONTAL CENTRIFUGAL PUMPS

1.00.00 SCOPE

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

2.00.00 CODES AND STANDARDS

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

2.02.00 **List of Applicable Standards**

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

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

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

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

v) IS : 5659 - Pumps for process water

vi) HIS - Hydraulic Institute Standards; USA

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

3.00.00 DESIGN REQUIREMENTS

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

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

3.03.00 Pumps of a particular category shall be identical and shall be suitable for parallel operation with equal load division. The head Vs capacity and BHP Vs capacity characteristics should match to ensure even load sharing and trouble-free operation throughout the range. Components of identical pumps shall be interchangeable.

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

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

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

4.00.00 DESIGN CONSTRUCTION

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

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

5.00.00 **Technical Data sheet of Pumps**

No	Designation\Application	Clarified/Raw/ Treated water	DM water
1)	Operating Speed	1500 rpm (nominal)	
2)	Pumps and drives to be designed for	Outdoor duty & Continuous Operation	
3)	Type of lubrication	Grease	
4)	Suction condition	Flooded Suction	
5)	Type of Shaft Sealing	Gland packing	Mechanical Seal
6)	Type of coupling (motor & pump)	Flexible	
11)	**Material of Construction**		
i)	Casing, Stuffing Box, Gland	2.5% Ni CI IS210 Gr FG 260	ASTM A CF8M
ii)	Impeller	ASTM A351 CF8M	
	Wearing rings (if applicable)	SS – 316	
iii)	Shaft, Shaft Sleeves	SS-410	
iv)	Bolts & nuts	SS 316 for those encountering water and for others, material shall be high tension carbon steel.	
v)	Base plate (min 12 mm thick)	Carbon Steel (Epoxy Painted)	
7)	Accessories	a. Required Instrumentation b. Companion flanges with nuts, bolts and gaskets, Anchor bolts, nuts, sleeves and inserts. c. Internal piping with valves, filters & Instruments for sealing/ cooling/ lubrication system up to and including isolating valve etc. d. Positioning dowels, Eye bolts, lifting etc. e. Ladders, Platforms & Other accessories	

TECHNICAL DATA - PART - A

SL.NO	DESCRIPTION	UOM	DETAIL -TYPE 1	DETAIL -TYPE 2	DETAIL -TYPE 3	DETAIL -TYPE 4	DETAIL -TYPE 5	DETAIL -TYPE 6	DETAIL -TYPE 7	DETAIL -TYPE 8	DETAIL -TYPE 9	DETAIL -TYPE 10	DETAIL -TYPE 11	DETAIL -TYPE 12
	Designation/Name of the Pump		**DMCW TG PUMPS**	**DMCW SG PUMPS**	**ACW PUMPS**	**BOILER FILL PUMPS**	**Condensate transfer PUMPS**	**DM MAKE UP PUMPS**	**CW MAKE UP PUMPS**	**SERVICE WATER PUMPS**	**HVAC MAKE UP PUMPS**	**APH/ ESP WASH PUMPS**	**FGD GYPSUM WASH PUMPS**	**FGD PROCESS WATER 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 & supervision of replacement of gland packing with Mechanical Seal arrangement (if applicable) at site for Miscellaneous Pumps along with mandatory spares complete with all accessories as per the requirements specified in this specification, 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)	No (HT Motor is free issue by BHEL)	No (HT Motor is free issue by BHEL)	Yes	Yes	Yes	Yes	Yes	Yes	No (HT Motor is free issue by BHEL)	Yes	Yes
1.1.2	Strainer at Pump Suction with Drain/Vent Valves		Yes, Conical Type	Yes, Conical Type	No	Yes, Conical Type	Yes, Conical Type	Yes, Conical Type	No	No	No	No	No	No
1.1.3	Pump motor coupling (Heavy duty) along with coupling guard		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1.1.4	Common base plate for pumps and motor		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1.1.5	Self contained lubrication system along with all internal piping, valves, fittings, specialties etc. as required		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1.1.6	Counter flanges for suction/ discharge nozzles along with fixing nuts, bolts and gaskets		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1.1.7	Anchor bolts, nuts, seating steel works, shims etc. as necessary for mounting the pump-motor unit on civil foundations		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1.1.8	Vent with piping, valves and Priming Connection on Pump Casing		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1.1.9	Drain connections in Casing and Base Plate with piping & isolating valves/plugs		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1.1.10	Lifting/ handling attachments/lugs for the pump and motor		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1.1.11	First fill of lubricants with toping requirements for one year of operation after commissioning and handing over of equipment		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1.1.12	Set of "Special" Tools & Tackles for Pumps and motors, if any		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1.1.13	Erection and commissioning spares, "on as required" basis		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1.1.14	RTD for each Pump Bearing		Yes	Yes	Yes	No	No	No	No	No	No	Yes	No	No
1.1.15	1 No. Reverse Rotation Indicating Switch for each Pump		No	No	No	No	No	No	No	No	No	No	No	No
1.1.16	Mandatory Spares (Details as per BOQ Schedule)		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1.2	Scope of Services:													
1.2.1	Installation Check of Pumps at site prior to their commissioning		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1.2.2	Replacement of Gland Packing with Mechanical Seal at Site after commissioning		Yes	Yes	NO	Yes	Yes	Yes	NO	NO	NO	NO	NO	NO
1.2.3	Performance Testing at Site		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2.0	**DESIGN CODES & STANDARDS**													
2.1	Design Standard		IS-6595/IS-5120/IS-5659/HIS											
2.2	Performance Standard		IS-9137/IS-5120/HIS/ASME PTC 8.2											
2.3	Strainer Housing/Body excluding Flange		ASME Sec VIII, DIV I											
2.4	Flange/Counter Flange		AWWA class - C-207											
2.5	Structural steel		IS 2062											
2.6	Cast Iron		IS 210											
2.7	Threaded Steel Fasteners		IS 1367											
2.8	Alloy-Steel and Stainless Steel Bolting		ASTM A193											
2.9	Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts		ASTM A194											
2.10	Carbon Steel Castings		ASTM A216											
2.11	Carbon Steel Forgings		ASTM A105											
2.12	Stainless Steel Castings		ASTM A351											
2.13	Stainless Steel Forgings		ASTM A276											

TECHNICAL SPECIFICATION
MISC. PUMPS (HORIZONTAL)
2X800 MW LARA STPP STAGE-II

PE-TS-508-100-W001
Rev. No. 00
Date : 25.04.25

TECHNICAL DATA - PART - A

SL.NO	DESCRIPTION	UOM	DETAIL -TYPE 1	DETAIL -TYPE 2	DETAIL -TYPE 3	DETAIL -TYPE 4	DETAIL -TYPE 5	DETAIL -TYPE 6	DETAIL -TYPE 7	DETAIL -TYPE 8	DETAIL -TYPE 9	DETAIL -TYPE 10	DETAIL -TYPE 11	DETAIL -TYPE 12
	Designation/Name of the Pump		**DMCW TG PUMPS**	**DMCW SG PUMPS**	**ACW PUMPS**	**BOILER FILL PUMPS**	**Condensate transfer PUMPS**	**DM MAKE UP PUMPS**	**CW MAKE UP PUMPS**	**SERVICE WATER PUMPS**	**HVAC MAKE UP PUMPS**	**APH/ ESP WASH PUMPS**	**FGD GYPSUM WASH PUMPS**	**FGD PROCESS WATER PUMPS**
2.14	Duplex Stainless Steel Castings		ASTM A890 / ASTM A995											
2.15	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.)		6 (six) nos. for station (3 nos per unit)	6 (six) nos. for station (3 nos per unit)	6 (six) nos. for station (3 nos per unit)	2 (two) nos. for station	2 (two) nos. for station	3 (three) nos. for station	3 (three) nos. for station	3 (three) nos. for station	2 (Two) nos. for station	2 (Two) nos. for station	2 (Two) nos. for station	1 (one) no. for station
3.3	No. of working & standby pumps		2 X (2 Working + 1 Standby)	2 X (2 Working + 1 Standby)	2 X (2 Working + 1 Standby)	1 Working + 1 Standby	2 Working + 0 Standby	2 Working + 1 Standby	2 Working + 1 Standby	2 Working + 1 Standby	1 Working + 1 Standby	1 Working + 1 Standby	1 Working + 1 Standby	1 Working
3.4	Location		Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor
3.5	Pump suitable for parallel operation		Yes	Yes	Yes	Not Applicable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3.6	Pump Duty		Continuous	Continuous	Continuous	Intermittent	Intermittent	Continuous	Continuous	Continuous	Continuous	Intermittent	Continuous	Intermittent
3.7	Rated capacity (No negative tolerance permitted)	cu.m/hr	1100	950	2600	200	300	150	1860	255	100	840	60	450
3.8	Total Dynamic Head (TDH) at rated capacity (No negative tolerance permitted)	MWC	35	41	14	150	75	75	10	60	85	90	20	35
3.9	Max. limit on shut off head Corresponding to pump TDH (MWC) at 51.5 Hz	MWC	115-130% of the rated head	115-130% of the rated head	115-130% of the rated head	115-130% of the rated head	115-130% of the rated head	115-130% of the rated head	115-130% of the rated head	115-130% of the rated head	115-130% of the rated head	115-130% of the rated head	115-130% of the rated head	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	40% to 120% of the rated flow	40% to 120% of the rated flow	40% to 120% of the rated flow	40% to 120% of the rated flow	40% to 120% of the rated flow	40% to 120% of the rated flow	40% to 120% of the rated flow	40% to 120% of the rated flow	40% to 120% of the rated flow	40% to 120% of the rated flow	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	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3.12	The pumps offered have stable rising H-Q curves within the "Range of Operation"		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3.13	Pump characteristics		Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable	Non Overloading type & stable
3.14	Maximum permissible speed of pump	RPM	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
3.15	Suction Pressure (Available)	MWC	24	37	20	Flooded Suction	Flooded Suction	Flooded Suction	Flooded Suction	Flooded Suction	Flooded Suction	Flooded Suction	Flooded Suction	Flooded Suction
3.16	System Design Pressure	kg/cm2 (g)	10	10	7.5	25	12	12	2.5	10	12	12	5	5
3.17	Design Temperature	Deg. C	60	60	60	60	60	60	60	60	60	60	60	60
3.18	Specific Gravity of fluid to be handled		1	1	1	1	1	1	1	1	1	1	1	1
3.19	Quality of Water Handled		Passivated DM Water	Passivated DM Water	Clarified Water	DM Water	DM Water	DM Water	Clarified Water	Clarified Water	Clarified Water	Clarified Water	Clarified Water	Clarified Water
3.20	Torque speed curve of the pump & drive motor furnished for pumps with drive motor rating of 100 KW and above.		Yes	Yes	Yes	Yes	Yes	NA	Yes	Yes	Yes	Yes	Yes	Yes
4.0	**CONSTRUCTION FEATURES**													
4.1	Type of Pump to be offered		Horizontal centrifugal type Between Bearing Pump	Horizontal centrifugal type Between Bearing Pump	Horizontal centrifugal type Between Bearing Pump	Horizontal centrifugal type Between Bearing Pump / Multi Stage Pump	Horizontal centrifugal type Between Bearing Pump / End Suction Pump	Horizontal centrifugal type Between Bearing Pump / End Suction Pump	Horizontal centrifugal type Between Bearing Pump / End Suction Pump	Horizontal centrifugal type Between Bearing Pump / End Suction Pump	Horizontal centrifugal type Between Bearing Pump / End Suction Pump	Horizontal centrifugal type Between Bearing Pump / End Suction Pump	Horizontal centrifugal type Between Bearing Pump / End Suction Pump	Horizontal centrifugal type Between Bearing Pump / End Suction Pump
4.2	Type of pump casing to be offered		Axially split type	Axially split type	Axially split type	Axially/Radial split type	Axially/Radial split type	Axially/Radial split type	Axially/Radial split type	Axially/Radial split type	Axially/Radial split type	Axially/Radial split type	Axially/Radial split type	Axially/Radial split type
4.3	Type of Impeller to be offered		Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
4.4	Type of Pump Lubrication allowed		Self Liquid/Grease	Self Liquid/Grease	Self Liquid/Grease	Self Liquid/Grease	Self Liquid/Grease	Self Liquid/Grease	Self Liquid/Grease	Self Liquid/Grease	Self Liquid/Grease	Self Liquid/Grease	Self Liquid/Grease	Self Liquid/Grease
4.5	Sealing Arrangement		Gland packing initially & Mechanical seal finally after commisioning	Gland packing initially & Mechanical seal finally after commisioning	Gland Packing	Gland packing initially & Mechanical seal finally after commisioning	Gland packing initially & Mechanical seal finally after commisioning	Gland packing initially & Mechanical seal finally after commisioning	Gland Packing	Gland Packing	Gland Packing	Gland Packing	Gland Packing	Gland Packing
4.6	Pump is designed so that pump internals can be attended without disturbing suction and discharge piping.		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4.7	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.											
4.8	Type of coupling between pump & motor		Flexible Type	Flexible Type	Flexible Type	Flexible Type	Flexible Type	Flexible Type	Flexible Type	Flexible Type	Flexible Type	Flexible Type	Flexible Type	Flexible Type
4.9	**Material of Construction**													
4.9.1	Casing		ASTM-A-351 CF 8M	ASTM-A-351 CF 8M	2.5% Ni CI to IS 210 GR FG-260	ASTM-A-351 CF 8M	ASTM-A-351 CF 8M	ASTM-A-351 CF 8M	2.5% Ni CI to IS 210 GR FG-260	2.5% Ni CI to IS 210 GR FG-260	2.5% Ni CI to IS 210 GR FG-260	2.5% Ni CI to IS 210 GR FG-260	2.5% Ni CI to IS 210 GR FG-260	2.5% Ni CI to IS 210 GR FG-260
4.9.2	Impeller		ASTM-A-351 CF 8M	ASTM-A-351 CF 8M	Bronze to IS 318 Gr. I/II or CF8M	ASTM-A-351 CF 8M	ASTM-A-351 CF 8M	ASTM-A-351 CF 8M	ASTM-A-351 CF 8M	ASTM-A-351 CF 8M	ASTM-A-351 CF 8M	ASTM-A-351 CF 8M	ASTM-A-351 CF 8M	ASTM-A-351 CF 8M
4.9.3	Shaft		SS 316	SS 316	EN-8 (BS-970)	SS 316	SS 316	SS 316	SS 410	SS 410	SS 410	SS 410	SS 410	SS 410

	TECHNICAL SPECIFICATION MISC. PUMPS (HORIZONTAL) 2X800 MW LARA STPP STAGE-II													PE-TS-508-100-W001 Rev. No. 00 Date : 25.04.25
	TECHNICAL DATA - PART - A													
SL.NO	**DESCRIPTION**	**UOM**	**DETAIL -TYPE 1**	**DETAIL -TYPE 2**	**DETAIL -TYPE 3**	**DETAIL -TYPE 4**	**DETAIL -TYPE 5**	**DETAIL -TYPE 6**	**DETAIL -TYPE 7**	**DETAIL -TYPE 8**	**DETAIL -TYPE 9**	**DETAIL -TYPE 10**	**DETAIL -TYPE 11**	**DETAIL -TYPE 12**
	Designation/Name of the Pump		**DMCW TG PUMPS**	**DMCW SG PUMPS**	**ACW PUMPS**	**BOILER FILL PUMPS**	**Condensate transfer PUMPS**	**DM MAKE UP PUMPS**	**CW MAKE UP PUMPS**	**SERVICE WATER PUMPS**	**HVAC MAKE UP PUMPS**	**APH/ ESP WASH PUMPS**	**FGD GYPSUM WASH PUMPS**	**FGD PROCESS WATER PUMPS**
4.9.4	Shaft sleeves		SS 410	SS 410	SS 410	SS 410	SS 410	SS 410	SS 410 (Hardened)	SS 410 (Hardened)	SS 410 (Hardened)	SS 410 (Hardened)	SS 410 (Hardened)	SS 410 (Hardened)
4.9.5	Impeller Wear ring (as applicable)		SS 316	SS 316	High leaded bronze to IS-318 Gr. V / SS 316 in case of SS impeller	SS 316	SS 316	SS 316	SS 316	SS 316	SS 316	SS 316	SS 316	SS 316
4.9.6	Casing Wear ring (as applicable)		SS 316	SS 316	SS 316	SS 316	SS 316	SS 316	SS 316	SS 316	SS 316	SS 316	SS 316	SS 316
4.9.7	Fasteners (Wetted)		SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316
4.9.8	Fasteners (Non-Wetted)		SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316
4.9.9	Coupling		CI	CI	CI	CI	CI	CI	CI	CI	CI	CI	CI	CI
4.9.10	Gland		SS 316	SS 316	2.5% Ni CI to IS 210 GR FG-260	SS 316	SS 316	SS 316	2.5% Ni CI to IS 210 GR FG-260	2.5% Ni CI to IS 210 GR FG-260	2.5% Ni CI to IS 210 GR FG-260	2.5% Ni CI to IS 210 GR FG-260	2.5% Ni CI to IS 210 GR FG-260	2.5% Ni CI to IS 210 GR FG-260
4.9.11	Stuffing Box		ASTM-A-351 CF 8M	ASTM-A-351 CF 8M	2.5% Ni CI to IS 210 GR FG-260	ASTM-A-351 CF 8M	ASTM-A-351 CF 8M	ASTM-A-351 CF 8M	2.5% Ni CI to IS 210 GR FG-260	2.5% Ni CI to IS 210 GR FG-260	2.5% Ni CI to IS 210 GR FG-260	2.5% Ni CI to IS 210 GR FG-260	2.5% Ni CI to IS 210 GR FG-260	2.5% Ni CI to IS 210 GR FG-260
4.9.12	Lantern ring		SS-316	SS-316	Bronze	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316	SS-316
4.9.13	Mechanical seals (faces)		As per Manufacturer standard	As per Manufacturer standard	Not applicable	As per Manufacturer standard	As per Manufacturer standard	As per Manufacturer standard	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
4.9.14	Gland packing		Teflon Impregnated (Non-Asbestos type)	Teflon Impregnated (Non-Asbestos type)	Teflon Impregnated (Non-Asbestos type)	Teflon Impregnated (Non-Asbestos type)	Teflon Impregnated (Non-Asbestos type)	Teflon Impregnated (Non-Asbestos type)	Teflon Impregnated (Non-Asbestos type)	Teflon Impregnated (Non-Asbestos type)	Teflon Impregnated (Non-Asbestos type)	Teflon Impregnated (Non-Asbestos type)	Teflon Impregnated (Non-Asbestos type)	Teflon Impregnated (Non-Asbestos type)
4.9.15	Water seal tube		SS tube	SS tube	SS tube	SS tube	SS tube	SS tube	SS tube	SS tube	SS tube	SS tube	SS tube	SS tube
4.9.16	Base plate		MS fabricated IS-2062 IS2062 E250 (min. thickness 12 mm), Epoxy Coated											
4.9.17	Counter Flange		Carbon Steel	Carbon Steel	Carbon Steel	SS 304	SS 304	SS 304	Carbon Steel	Carbon Steel	Carbon Steel	Carbon Steel	Carbon Steel	Carbon Steel
4.9.18	Suction Strainer Housing/Body		CS as per IS :2062	CS as per IS :2062	NA	SS304	SS304	SS304	NA	NA	NA	NA	NA	NA
4.9.19	Suction Strainer Element / Basket including Basket Stiffeners and Handle		SS316	SS316	NA	SS316	SS316	SS316	NA	NA	NA	NA	NA	NA
4.9.20	Suction Strainer Gasket		Nitrile Rubber / EPDM (Min. 3 mm thick)	Nitrile Rubber / EPDM (Min. 3 mm thick)	NA	Nitrile Rubber / EPDM (Min. 3 mm thick)	Nitrile Rubber / EPDM (Min. 3 mm thick)	Nitrile Rubber / EPDM (Min. 3 mm thick)	NA	NA	NA	NA	NA	NA
4.10	Design Life of Bearing	Hrs	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000
4.11	Sealing/Cooling of Stuffing Box		By Self Water	By Self Water	By Self Water	By Self Water	By Self Water	By Self Water	By Self Water	By Self Water	By Self Water	By Self Water	By Self Water	By Self Water
4.12	Type of Mechanical Seal (If applicable)		Cartridge Type	Cartridge Type	Cartridge Type	Cartridge Type	Cartridge Type	Cartridge Type	Cartridge Type	Cartridge Type	Cartridge Type	Cartridge Type	Cartridge Type	Cartridge Type
4.13	Cooling/Lubrication Arrangement to be provided for Mechanical Seal		By Self Water	By Self Water	By Self Water	By Self Water	By Self Water	By Self Water	By Self Water	By Self Water	By Self Water	By Self Water	By Self Water	By Self Water
4.14	The bidder shall make provisions for mounting following on the pump/ pump shaft: a. Purchaser's probes in both DE/NDE 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	Yes	Yes	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Yes	Not Applicable	Not Applicable
4.15	**Construction Features of Suction Strainer**													
4.15.1	Type of Strainer		Conical type	Conical type	NA	Conical type	Conical type	Conical type	NA	NA	NA	NA	NA	NA
4.15.2	Type of Strainer Element		Wire Mesh supported with Perforated Plate	Wire Mesh supported with Perforated Plate	NA	Wire Mesh supported with Perforated Plate	Wire Mesh supported with Perforated Plate	Wire Mesh supported with Perforated Plate	NA	NA	NA	NA	NA	NA
4.15.3	Perforation/Mesh size		10 Mesh (2 mm)	10 Mesh (2 mm)	NA	10 Mesh (2 mm)	10 Mesh (2 mm)	10 Mesh (2 mm)	NA	NA	NA	NA	NA	NA
4.15.4	Maximum Permissible Pressure Drop under Clean condition	MWC	by Bidder	by Bidder	NA	by Bidder	by Bidder	by Bidder	NA	NA	NA	NA	NA	NA
4.15.5	Strainer Inlet/ outlet Nozzle Size		To suit pump suction size						NA					
4.15.6	Length of strainer (including counterflanges)	mm	700	600	NA	300	300	200	NA	NA	NA	NA	NA	NA
4.15.7	Ratio of Screen Clear Flow Area vis-à-vis Pipe Inlet Area		3	3	NA	3	3	3	NA	NA	NA	NA	NA	NA
4.15.8	Orientation of Inlet/Outlet Connecting Pipe		Horizontal and Co-axial	Horizontal and Co-axial	NA	Horizontal and Co-axial	Horizontal and Co-axial	Horizontal and Co-axial	NA	NA	NA	NA	NA	NA
4.15.9	Type of Welding allowed for fabrication of Strainer Basket/Element		Only TIG Welding	Only TIG Welding	NA	Only TIG Welding	Only TIG Welding	Only TIG Welding	NA	NA	NA	NA	NA	NA
4.15.10	End Conection		Flanged	Flanged	NA	Flanged	Flanged	Flanged	NA	NA	NA	NA	NA	NA
5.0	**PERFORMANCE PARAMETERS**													
5.1	Performance Guarantee Tests at Shop/Works		Yes, To be performed by Manufacturer	Yes, To be performed by Manufacturer	Yes, To be performed by Manufacturer	Yes, To be performed by Manufacturer	Yes, To be performed by Manufacturer	Yes, To be performed by Manufacturer	Yes, To be performed by Manufacturer	Yes, To be performed by Manufacturer	Yes, To be performed by Manufacturer	Yes, To be performed by Manufacturer	Yes, To be performed by Manufacturer	Yes, To be performed by Manufacturer

TECHNICAL SPECIFICATION
MISC. PUMPS (HORIZONTAL)
2X800 MW LARA STPP STAGE-II

PE-TS-508-100-W001
Rev. No. 00
Date : 25.04.25

TECHNICAL DATA - PART - A

SL.NO	DESCRIPTION	UOM	DETAIL -TYPE 1	DETAIL -TYPE 2	DETAIL -TYPE 3	DETAIL -TYPE 4	DETAIL -TYPE 5	DETAIL -TYPE 6	DETAIL -TYPE 7	DETAIL -TYPE 8	DETAIL -TYPE 9	DETAIL -TYPE 10	DETAIL -TYPE 11	DETAIL -TYPE 12
	Designation/Name of the Pump		**DMCW TG PUMPS**	**DMCW SG PUMPS**	**ACW PUMPS**	**BOILER FILL PUMPS**	**Condensate transfer PUMPS**	**DM MAKE UP PUMPS**	**CW MAKE UP PUMPS**	**SERVICE WATER PUMPS**	**HVAC MAKE UP PUMPS**	**APH/ ESP WASH PUMPS**	**FGD GYPSUM WASH PUMPS**	**FGD PROCESS WATER PUMPS**
5.2	Performance Guarantee Tests at Site		Yes, To be performed by Manufacturer	Yes, To be performed by Manufacturer	Yes, To be performed by Manufacturer	Yes, To be performed by Manufacturer	Yes, To be performed by Manufacturer	Yes, To be performed by Manufacturer	Yes, To be performed by Manufacturer	Yes, To be performed by Manufacturer	Yes, To be performed by Manufacturer	Yes, To be performed by Manufacturer	Yes, To be performed by Manufacturer	Yes, To be performed by Manufacturer
5.3	Benchmark Pump efficiency (P) for Bid evaluation	%	85	84	86	Not Applicable	Not Applicable	65	85	80	62	NA	70	80
5.4	Benchmark Motor efficiency(M) for Bid evaluation	%	95.8	95.8	95.8	Not Applicable	Not Applicable	95	95.2	95	94.6	NA	90.4	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	4 lacs	-	-	4 lacs	4 lacs	4 lacs	4 lacs	-	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	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	5.6	4.8	4.8
5.7	Guaranteed vibration at site on any pump /motor bearing w.r.t. velocity (Vrms) as per ANSI/ HIS 9.6.4	Vrms	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	4.8	3.8	3.8
5.8	Max. noise Level (Guaranteed at site)	dB	85 dB at 1 M distance	85 dB at 1 M distance	85 dB at 1 M distance	85 dB at 1 M distance	85 dB at 1 M distance	85 dB at 1 M distance	85 dB at 1 M distance	85 dB at 1 M distance	85 dB at 1 M distance	85 dB at 1 M distance	85 dB at 1 M distance	85 dB at 1 M distance

ANNEXURE-II

BHEL	TECHNICAL SPECIFICATION **MISC. PUMP** LARA SUPER THERMAL POWER PROJECT STAGE-II (2X800 MW)	PE-TS-XXX-YYY-HZZZ Issue No: 01 Rev. No. 00 Date : 27.02.2025

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	Energy Efficient motors		IS 12615, IEC:60034-30
1.3	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
1.4	Designation of Methods of Cooling of Rotating Electrical Machines		IS 6362
1.5	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)
2.4	System fault level at rated voltage for 1 sec	kA	50
2.5	Short time rating for terminal boxes for 0.25 sec	kA	50
2.6	Type of motors		Squirrel cage induction motor
a)	Non-VFD		Suitable for direct on line starting
b)	VFD (if applicable)		Suitable for inverter duty
2.7	Efficiency class		
a)	Output rating (at 50 deg.C ambient temperature)		Efficiency class
i)	upto 50 KW		IE4
ii)	50- 200 KW		IE3
2.8	Rating		
a)	Motor duty		Continuously 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 application		IP 55
	ii) Outdoor application		IP 55 (Additional Canopy to be provided)
b)	Method of ventilation		Totally enclosed fan cooled (TEFC) type
3.3	Insulation		
a)	Class		'F' with temperature rise limited to class 'B'
b)	General Characteristics		Non-hygroscopic, oil resistant, flame resistant

c)	Special Characteristics		VPI insulation for VFD motors
3.4	Bearings		
a)	Horizontal motors		Grease lubricated ball or roller bearings
b)	Vertical motors		Grease lubricated ball or roller bearings or combined thrust and guide beaing
3.5	Main terminal box		
a)	Type		Detachable type
b)	Location		In accordance with Indian Standards clearing the motor base-plate/ foundation
c)	Terminals		Stud or lead wire type, substantially constructed and thoroughly insulated from the frame
d)	Markings		Phase markings on terminals and direction of rotation marked on the non-driving end
e)	DOP		Same as motor
f)	Position when veiwed from the non driving end		Left hand side
g)	Rotation		90 Deg.
h)	Space heater (for ratings 30 kW and above)		Suitable for 240V, 50Hz 1 ph AC. Separate terminal box provided for space heaters.
f)	Cable glands/lugs/gland plates		
i)	Size		As per cable size used
ii)	Lugs		Solderless crimpting type heavy duty (Aluminium lugs for Aluminium cables and copper lugs for copper cables)
iii)	Glands		Double compression Ni-Cr plated brass glands
iv)	Gland plate thickness		3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables)
3.6	Earthing points		
a)	No. of points on motor body		Two earthing points on opposite sides with two separate and distinct grounding pads complete with tapped holes, GI bolts and washers.
b)	No. of points on motor terminal box		One earthing point complete with tapped holes, GI bolts and washers.
c)	Earthing Flat size		
i)	LT Motors above 125 KW		50 x 6mm GS flat
ii)	25 KW to 125 KW		25 x 6mm GS flat
iii)	1KW to 25 KW		25 x 3mm GS flat
iv)	Fractional kW		8 SWG GS Wire
3.7	Painting		Corrosion proof epoxy based paint with suitable additives to be used.
a)	Paint shade		RAL 5012 (Blue)
b)	Thickness of paint		The thickness of finish coat shall be minimum 50 microns (minimum total DFT 100 microns).
3.8	Minimum spacing between gland plate & centre of bottom terminal stud		
a)	UP to 3 KW		As per manufacturer's practice.
b)	Above 3 KW - upto 7 KW		85 mm
c)	Above 7 KW - upto 13 KW		115 mm
d)	Above 13 KW - upto 24 KW		167 mm

e)	Above 24 KW - upto 37 KW		196 mm
f)	Above 37 KW - upto 55 KW		249 mm
g)	Above 55 KW - upto 90 KW		277 mm
h)	Above 90 KW - upto 125 KW		331 mm
i)	Above 125 KW-upto 200 KW		385/203 (For Single core cables only) mm
3.9	Minimum inter-phase and phase-earth air clearances with lugs installed		
a)	UP to 110 KW		10mm
b)	Above 110 KW and upto 150 KW		12.5mm
c)	Above 150 KW		19mm
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 rated speed		a) Up to 85% of rated voltage for ratings below 110 KW b) Up to 80% of rated voltage for ratings from 110 KW to 200 KW
b)	Maximum locked rotor current		As per IS 12615
c)	Starting duty		Two hot starts in succession, with motor initially at normal running temperature.
d)	The locked rotor withstand time		Speed switches mounted on the motor shaft shall be provided in cases where below requirements are not met.
	Starting time of motors at minimum permissible voltage during starting		The locked rotor withstand time under hot condition at highest voltage limit
i)	upto 20 secs.		atleast 2.5 secs. more than starting time
ii)	more than 20 secs. and upto 45 secs		atleast 5 secs. more than starting time
iii)	more than 45 secs.		more than starting time by at least 10% of the starting time
e)	Ratio of locked rotor KVA at rated voltage to rated KW (max.)		
i)	Below110KW		10
ii)	From 110 KW & upto 200 KW		9
4.2	Torque		
a)	Accelerating torque at any speed with the lowest permissible starting voltage		at least 10% motor full load torque
b)	Pull out torque at rated voltage		at least 205% of full load torque
4.3	Noise level (max.)		85 dB(A)
4.4	Vibration limits		As per IS 12075
5.0	**INSPECTION/TESTING**		

5.1	LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED. The following type test reports shall be submitted for each type and rating of LT motor of above 100 KW only. 1. Measurement of resistance of windings of stator and wound rotor. 2. No load test at rated voltage to determine input current power and speed 3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors) 4. Full load test to determine efficiency power factor and slip 5. Temperature rise test 6. Momentary excess torque test. 7. High voltage test 8. Test for vibration severity of motor. 9. Test for noise levels of motor(Shall be limited as mentioned above.) 10. Test for degree of protection and 11. Overspeed test.		
5.2	The type test listed above should have been conducted within 10 yrs prior to supply under this contract. In absence of type tests reports or in case reports are not found to be meeting the specification/standards requirements, vendor shall conduct all such type tests without any commercial/delivery implication to BHEL according to the relevant standards and reports shall be submitted to the owner for approval.		
5.3	The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and “No design Change”. Minor changes if any shall be highlighted on the endorsement sheet.		
5.4	All acceptance and routine tests as per the specification and relevant standards shall be carried out.Charges for these shall be deemed to be included in the equipment price.		
5.5	For motor rating upto 50 KW, BHEL QP No. PE-QP-999-Q-006 Rev 02 is to be followed. For motor ratings above 50 kW NTPC Quality assurance plan will be followed.		

	TECHNICAL SPECIFICATION MISC. PUMPS (HORIZONTAL) 2X800 MW LARA STPP STAGE-II	PE-TS-508-100-W001 Rev. No. 00 Date : 25.04.25

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
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 application.
	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

BHEL	TECHNICAL SPECIFICATION MISC. PUMPS (HORIZONTAL) 2X800 MW LARA STPP STAGE-II		PE-TS-508-100-W001 Rev. No. 00 Date : 25.04.25
	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
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

	TECHNICAL SPECIFICATION MISC. PUMPS (HORIZONTAL) 2X800 MW LARA STPP STAGE-II	PE-TS-508-100-W001 Rev. No. 00 Date : 25.04.25

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	Shut off head	MWC	
2.5	Range of Operation of the Pump		
	a) Min.Flow	M^3/hr	
	b) Max.Flow	M^3/hr	
2.6	The pumps offered have continuously rising head capacity curves from the duty point towards shut off point.		
2.7	The pumps offered have stable rising H-Q curves within the "Range of Operation"		
2.8	Pump rated speed	RPM	
2.9	Vibration measurements (2.9.2 is applicable in addition to 2.9.1 for Pumps with speed less than 600 RPM)		
2.9.1	Max.value of vibration on any pump /motor bearing w.r.t. velocity (Vrms) as per ANSI/ HIS 9.6.4 for speed > 600 RPM		
	a) Guaranteed at manufacturer's works	mm/s	
	b) Guaranteed at site	mm/s	
2.9.2	Max.value of vibration on any pump /motor bearing w.r.t. peak to peak amplitude as per ANSI/ HIS 9.6.4 for speed <= 600 RPM		
	a) Guaranteed at manufacturer's works	microns	
	b) Guaranteed at site	microns	
2.10	Max. noise Level (Guaranteed at site)	dB	
2.11	Guaranteed Pump efficiency at rated head & rated capacity without -ve tolerance	%	
2.12	Power consumption		
	a) Guaranteed pump input power at duty point	KW	

	b)	Guaranteed max. Pump input power within range of operation.	KW	
	c)	Max. pump input power at shut off	KW	
	d)	Guranteed power at motor input	KW	
2.13	NPSH required at rated capacity		MWC	
3.0	**DESIGN & CONSTRUCTION FEATURES**			
3.1	Type of pump casing			
3.2	Pump duty			
3.3	Type of Impeller			
3.4	Location			
3.5	Pump suitable for parallel operation			
3.6	Torque speed curve of the pump & drive motor furnished for pumps with drive motor rating of 100 KW			
3.7	Pump number of stages			
3.8	Specific speed N= $\frac{\text{RPM x (Flow in USGPM)}^{1/2}}{\text{(Head in Ft.)}^{3/4}}$			
3.9	Minimum suction head required in MLC for pump operation at maximum discharge point within the 'Range of Operation' specified (NPSHR at max. flow).			
3.10	Whether pump is suitable/designed so that pump internals can be attended without disturbing suction and discharge piping.			
3.11	Type of coupling between pump & motor			
3.12	Bearing (DE & NDE)			
	a)	Type and manufacturer		
	b)	Bearing no.		
	c)	Type of lubrication		
	d)	Design life (Hrs.)		
3.13	Shaft Sealing arrangement			
	a)	Type and Make/Model details		
	b)	Sealing liquid		
	c)	Requirement of external water if any		
		i) Quality		
		ii) Quantity/ Pump	M^3/hr	
3.14	In case separate oil/grease/water pump or any such equipment required for bearing lubrication/stuffing box gland sealing,furnish full technical details of these equipment and their drive.			
3.15	Critical Speed of Pump Rotating Assembly		RPM	
4.0	**MATERTIAL OF CONSTRUCTION (Indicate applicable code/ standard)**			

4.1	Casing		
4.2	Impeller		
4.3	Shaft		
4.4	Shaft sleeves		
4.5	Wear ring		
4.6	fasteners		
4.7	Gland		
4.8	Lantern ring		
4.9	Mechanical seals (faces)/		
	Gland packing		
4.10	Base plate		
5.0	**CONNECTIONS AND OTHER DIMENSIONAL DETAILS**		
5.1	Impeller diameter	mm	
6.0	**DRIVE DATA**		
6.1	Drive unit output at 50^{o}C ambient condition	KW/ P	
7.0	**INSPECTION & TESTING**		
7.1	Material test		
7.2	Hydrostatic test pressure	Kg/cm^2	
7.3	Hydrostatic test duration	Min.	
7.4	Performance test on pump at shop		
7.5	Dyanamic balance test		
8.0	**WEIGHT AND LOADING DATA**		
8.1	Weight of the pump & drive assembly	Kg	
8.2	Weight of the heaviest piece to be handled	Kg	
8.3	Size of base plate (length x width)	mm	

ANNEXURE-III

	TECHNICAL SPECIFICATION MISC. PUMP LARA SUPER THERMAL POWER PROJECT STAGE-II (2X800 MW)	PE-TS-XXX-YYY-HZZZ Issue No: 01 Rev. No. 00 Date :

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 SPECIFICATION MISCELLANEOUS PUMPS 2x800MW NTPC LARA TPP STAGE II	PE-TS-508-100-W001 Rev. No. 00 Date : 25.04.25

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		

	TECHNICAL SPECIFICATION MISC. PUMPS (HORIZONTAL) 2X800 MW LARA STPP STAGE-II	PE-TS-508-100-W001 Rev. No. 00 Date : 25.04.25

COMPLIANCE DRAWING

1 WATER ANALYSIS
2 ELECTRICAL SCOPE SPLIT
3 C&I DRAWINGS

BHEL	TECHNICAL SPECIFICATION MISC. PUMPS (HORIZONTAL) 2X800 MW LARA STPP STAGE-II	PE-TS-508-100-W001 Rev. No. 00 Date : 25.04.25

A. Passivated DM WATER ANALYSIS:

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

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

REV: 0 DATE: 27.02.2025

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

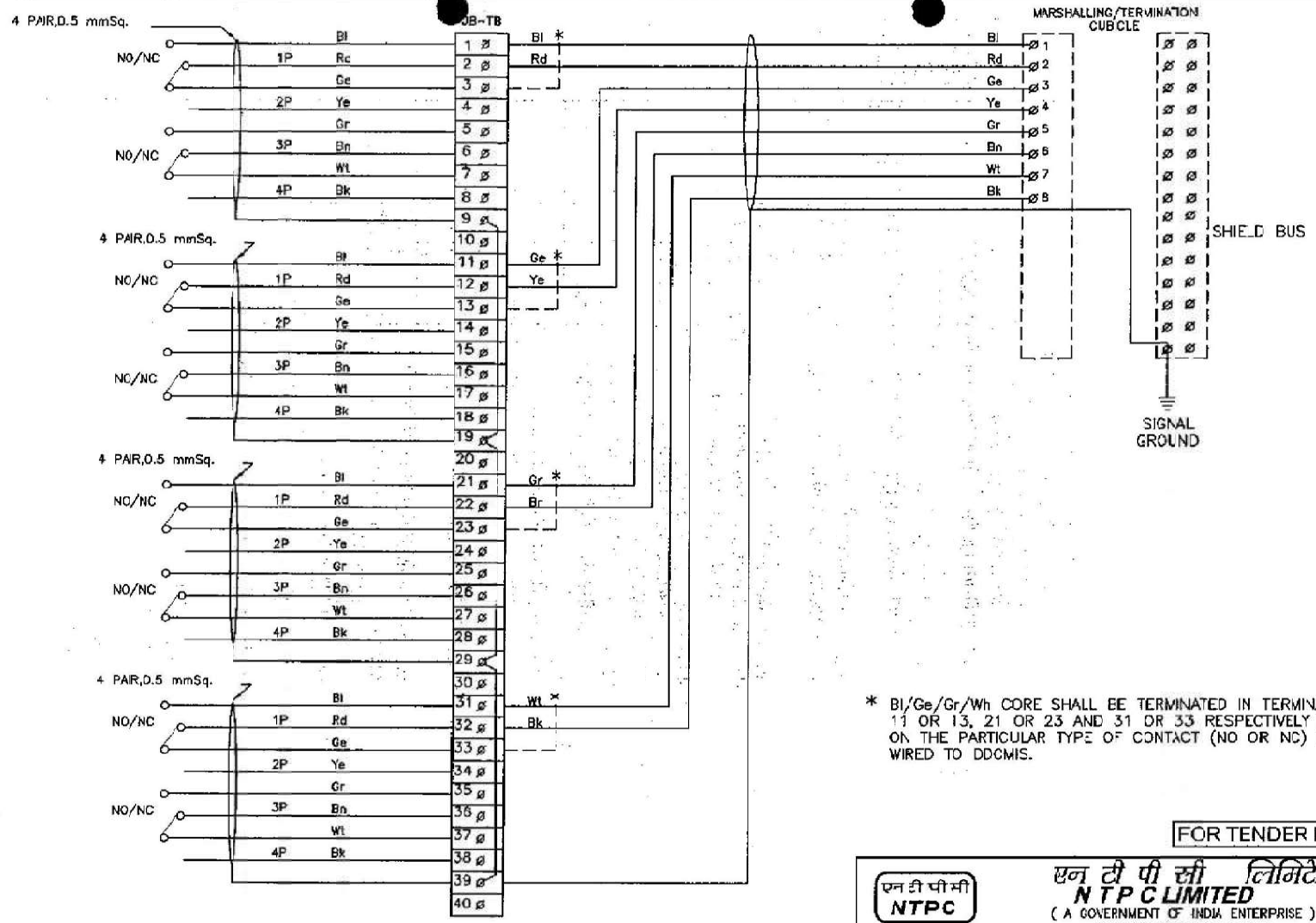
PACKAGE: MISC. PUMP (Supply Package)

PROJECT: 2X800 MW LARA STPP STAGE-II

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

NOTES:

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



* 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

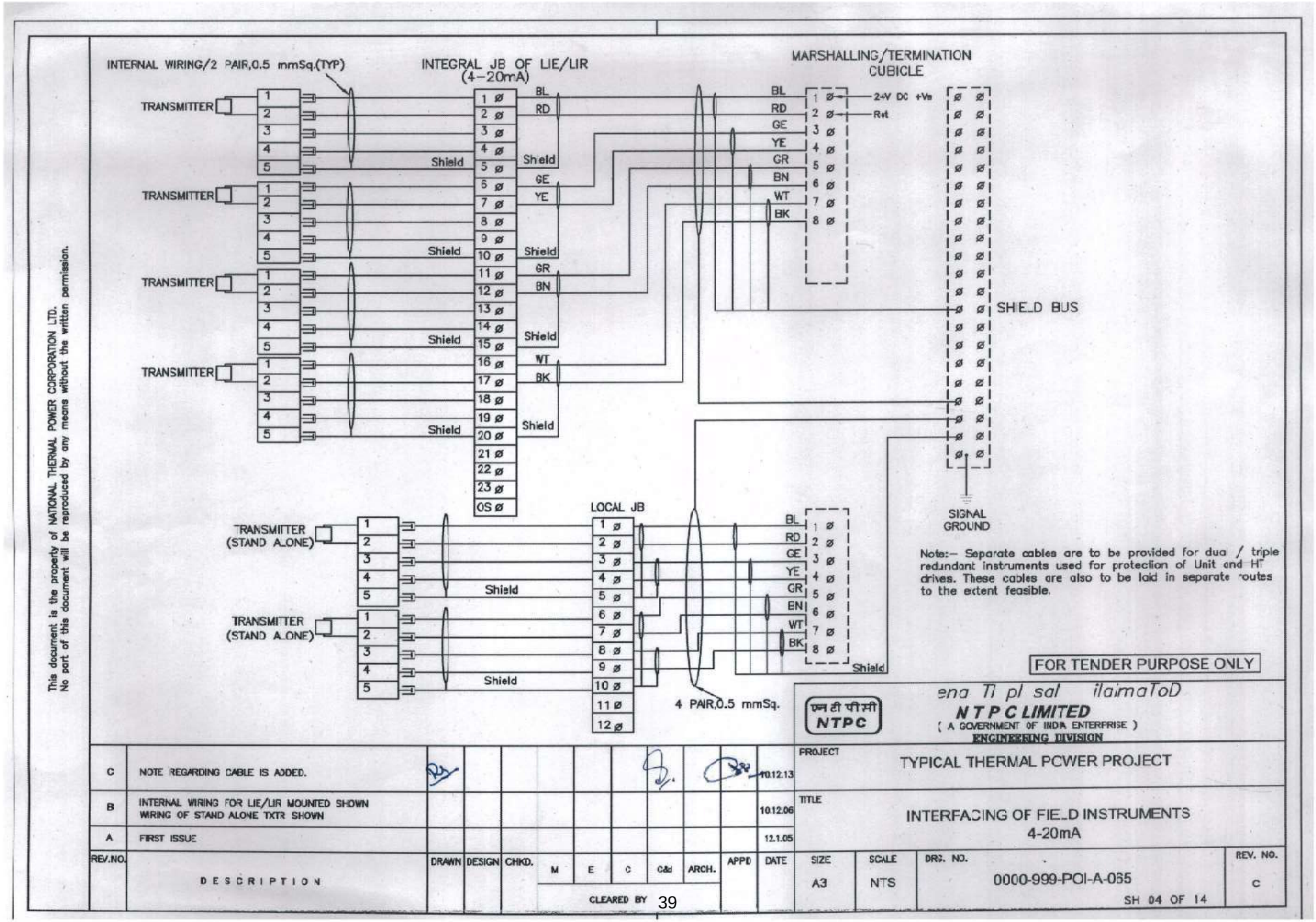
PROJECT: TYPICAL THERMAL POWER PROJECT

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


INTERNAL WIRING/2 PAIR,0.5 mmSq.(TYP)
INTEGRAL JB OF LIE/LIR (4-20mA)
MARSHALLING/TERMINATION CUBICLE
TRANSMITTER
TRANSMITTER
TRANSMITTER
TRANSMITTER
Shield
BL
RD
GE
YE
GR
BN
WT
BK
2-V DC +Ve
Ret
SHIELD BUS
SIGNAL GROUND
LOCAL JB
TRANSMITTER (STAND ALONE)
TRANSMITTER (STAND ALONE)
4 PAIR,0.5 mmSq.
Note:- Separate cables are to be provided for dua / triple redundant instruments used for protection of Unit and HT drives. These cables are also to be laid in separate routes to the extent feasible.
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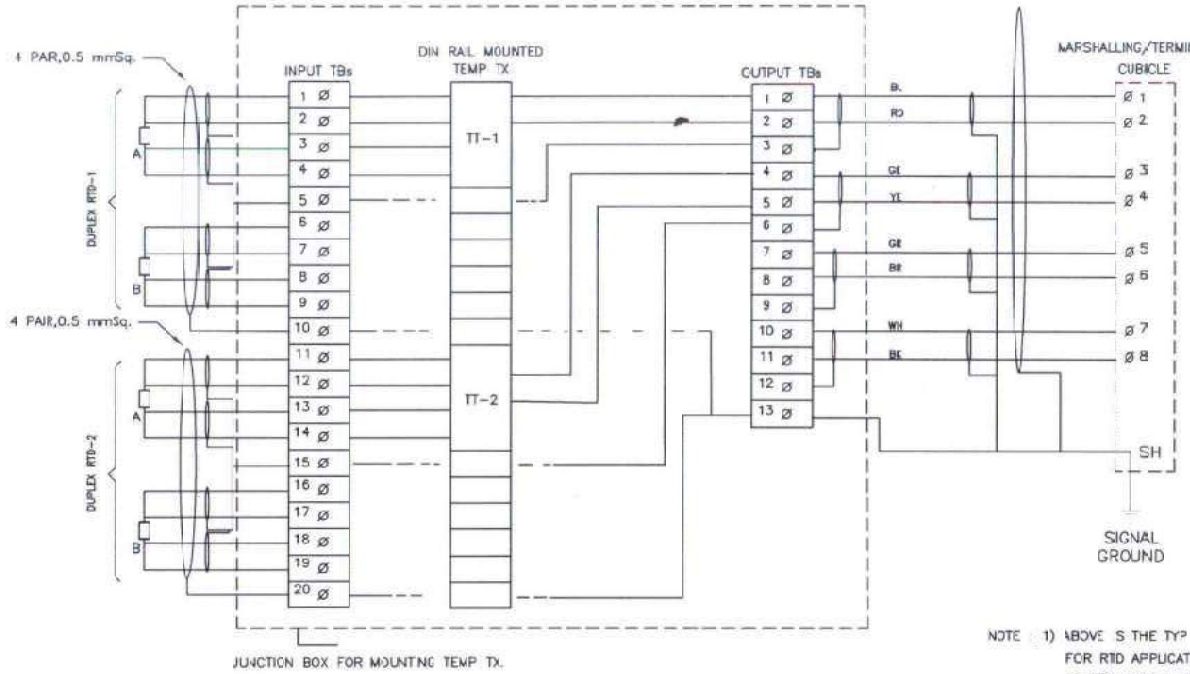
NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION
PROJECT
TYPICAL THERMAL POWER PROJECT
TITLE
INTERFACING OF FIELD INSTRUMENTS
4-20mA
C NOTE REGARDING CABLE IS ADDED. 10.12.13
B INTERNAL WIRING FOR LIE/LIR MOUNTED SHOWN WIRING OF STAND ALONE TXTR SHOWN 10.12.06
A FIRST ISSUE 12.1.05
REV.NO. DESCRIPTION DRAWN DESIGN CHKD. M E C C&I ARCH. APPD DATE
CLEARED BY 39
SIZE A3
SCALE NTS
DRG. NO. 0000-999-POI-A-055
SH 04 OF 14
REV. NO. C



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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NTPC LIMITED
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ENGINEERING DIVISION

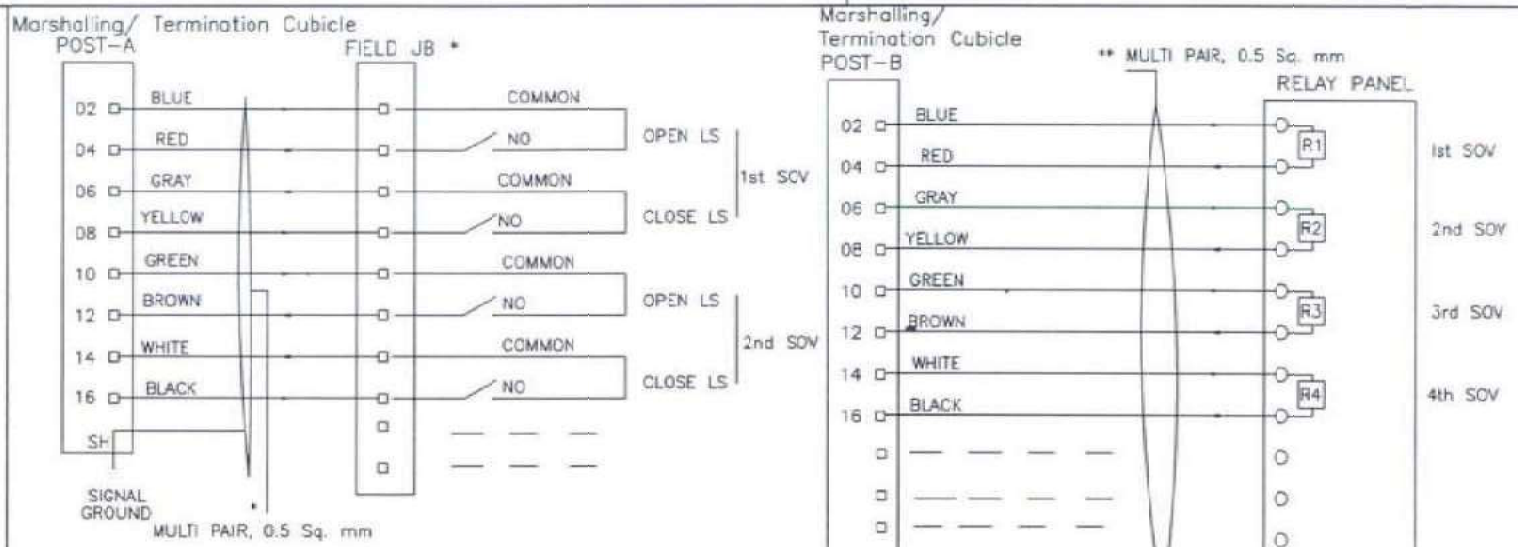
PROJECT: TYPICAL THERMAL POWER PROJECT

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

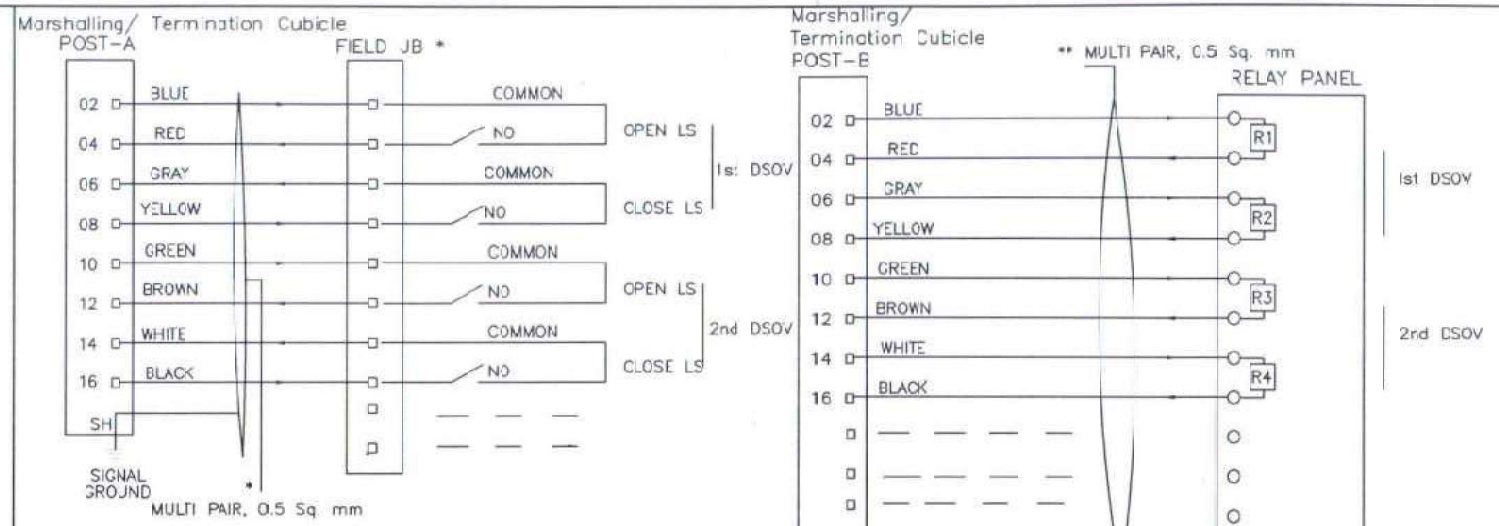
PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INTERFACING OF FIELD INSTRUMENTS
INTERFACE OF DDCMIS WITH MCC/SWGR/ACTUATOR
(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.

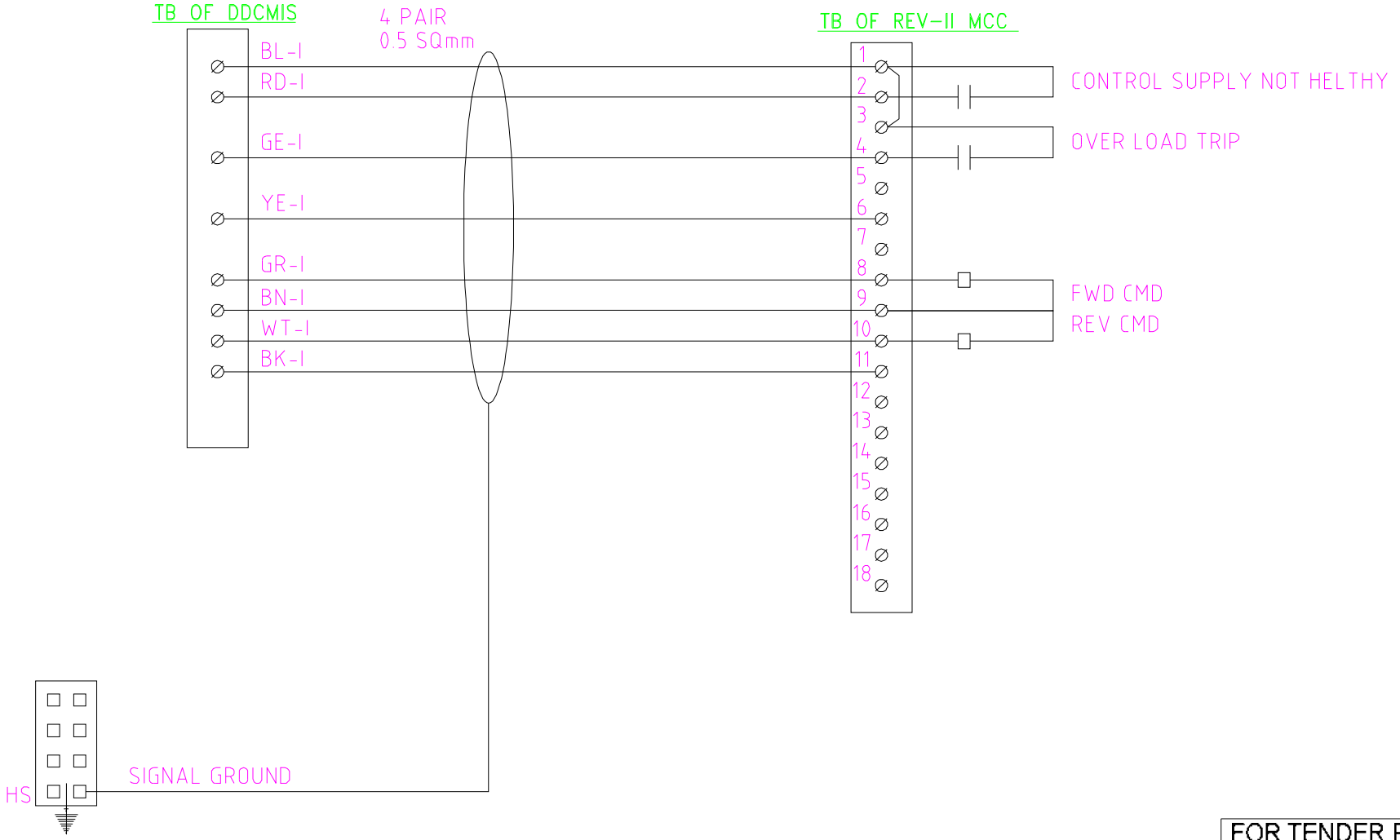
एनटीपीसी NTPC
नैशनल थर्मल पावर कारपोरेशन लिमिटेड
National Thermal Power Corporation Ltd
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

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				CLEARED BY						30.10.02

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



FOR TENDER PURPOSE ONLY

एन टी पी सी NTPC

National Thermal Power Corporation Ltd.

(A GOVERNMENT OF INDIA ENTERPRISE)

ENGINEERING DIVISION

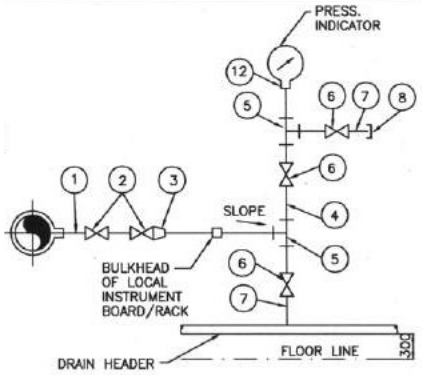
PROJECT: TYPICAL THERMAL POWER PROJECT CHP

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

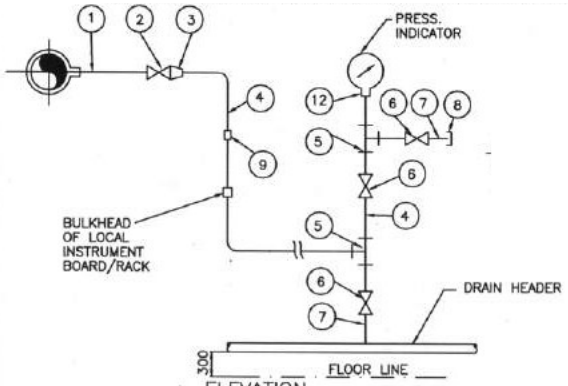
SIZE	SCALE	DRG. NO.	REV. NO.
A3	N.T.S.	0000-155-POI-A-065 SH 07	A



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.

FOR TENDER PURPOSE ONLY

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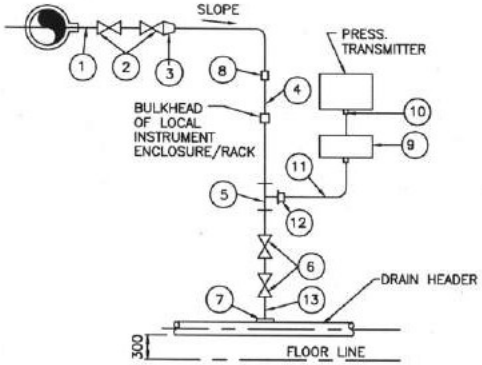
N T P C LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INSTRUMENT INSTALLATION DIAGRAM (FOR PRESSURE GAUGE)

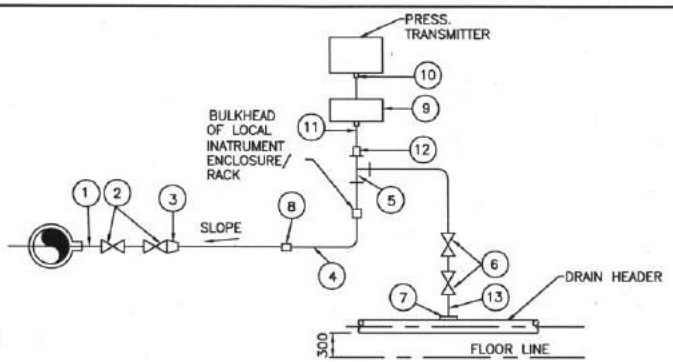
REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE							T.G.			21.08.12
		CLEARED BY									

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



ELEVATION

TRANSMITTER MOUNTED BELOW INSTRUMENT SOURCE POINT



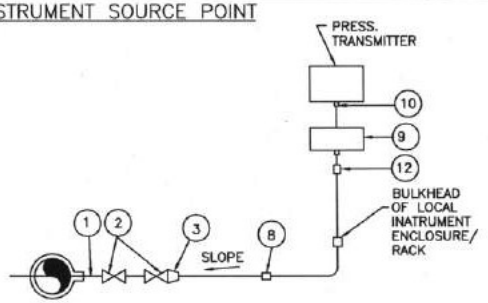
ELEVATION

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.

FOR TENDER PURPOSE ONLY

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

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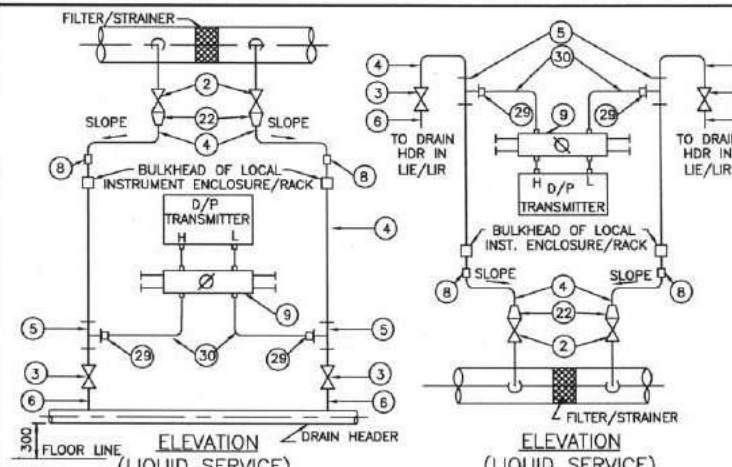
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

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

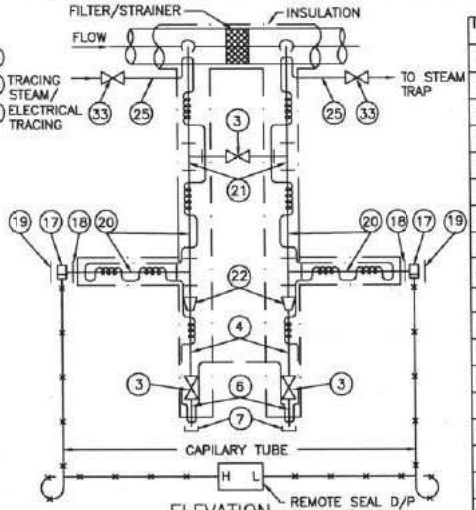


ELEVATION
(LIQUID SERVICE)

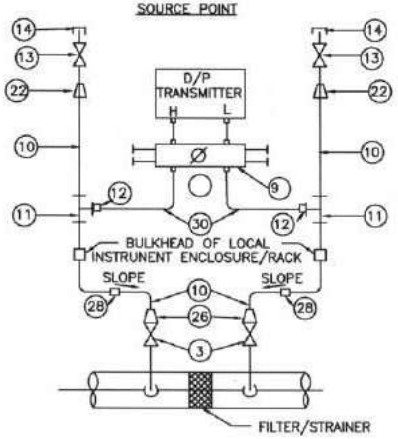
TRANSMITTER MOUNTED BELOW INSTRUMENT SOURCE POINT

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.

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

PROJECT: TYPICAL THERMAL POWER PROJECT

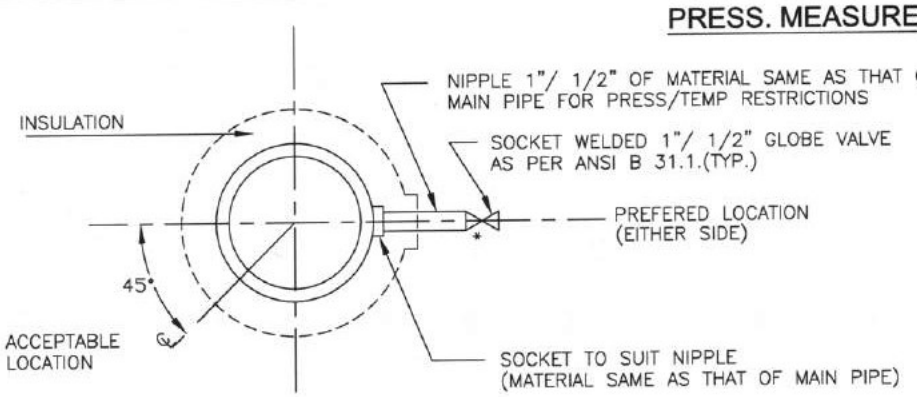
TITLE: INSTRUMENT INSTALLATION DIAGRAM
DIFF. PRESS.MEASUREMENT (LIQUID, OIL, AIR/GAS SERVICE)

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

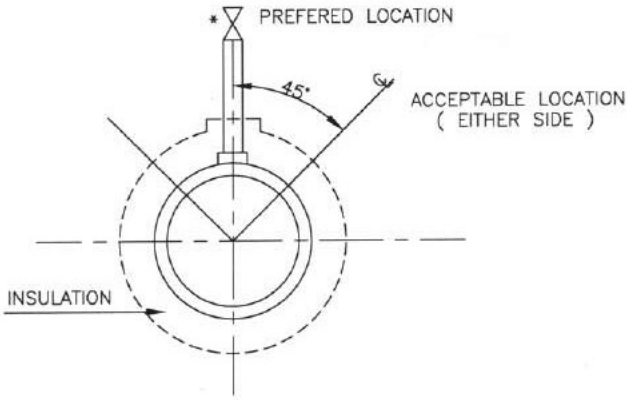
CLEARED BY

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

PRESS. MEASUREMENT

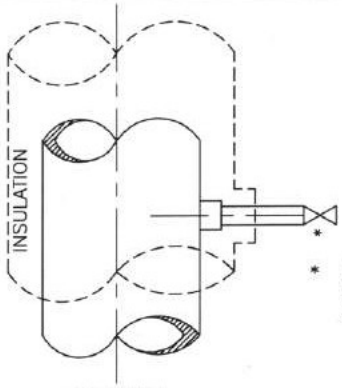


ELEVATION
LIQUID SERVICE



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

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REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD.	DATE
A	FIRST ISSUE							T.G.			21.06.18
					CLEARED BY						

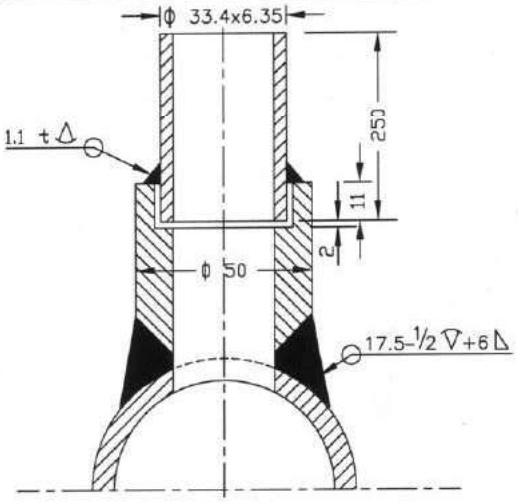
PROJECT: TYPICALTHERMAL POWER PROJECT

TITLE: INSTRUMENT SOURCE CONNECTION DETAILS

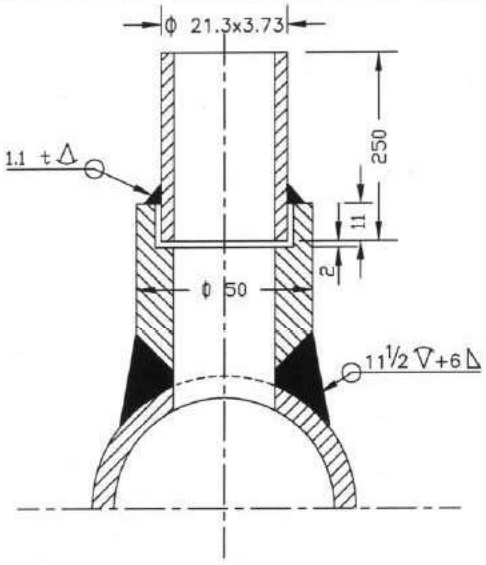
SIZE	SCALE	DRG. NO.	REV. NO.
A4	N.T.S.	0000-999-POI-A-035 Sh-1 Of 14	A

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

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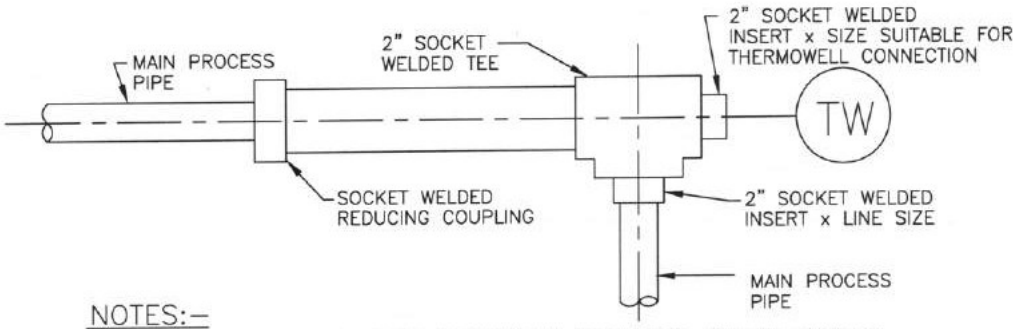
NTPC — NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION

PROJECT: TYPICALTHERMAL POWER PROJECT

TITLE: INSTRUMENT SOURCE CONNECTION DETAILS

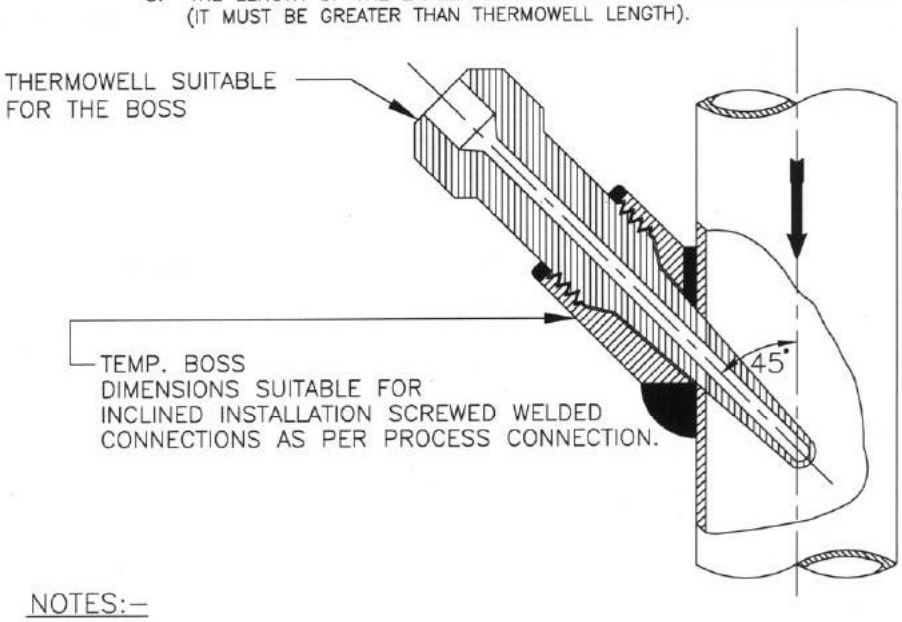
SIZE	SCALE	DRG. NO.	REV. NO.
A4	N.T.S.	0000-999-POI-A-035 Sh-2 Of 14	A

TEMP. MEASUREMENT



NOTES:–

1. THIS TYPE OF THERMOWELL INSTALLATION IS SUITABLE FOR THE PROCESS PIPE OF 2" NPS AND SMALLER.
2. FOR STEAM SERVICE THIS TYPE OF THERMOWELL INSTALLATION 90° BEND MAY BE USED ONLY IN VERTICAL PLANE.
3. THE LENGTH OF THE LARGER PIPE SECTION SHALL BE MINIMUM 150mm (IT MUST BE GREATER THAN THERMOWELL LENGTH).



NOTES:–

1. INCLINED INSTALLATION OF THERMOWELL SHALL BE APPLICABLE FOR 4" AND SMALLER LINE SIZE BUT LIMITED TO MIN. 3" LINE SIZE.
2. FOR 2" AND SMALLER LINE SIZE NECESSARY EXPANDER OF MIN. 3" SIZE OF MAIN PIPING SPECIFICATION SHALL BE USED.
3. THIS TYPE OF INSTALLATION IS APPLICABLE FOR HORIZONTAL AND VERTICAL PIPE SECTION.
4. FOR STEAM SERVICES EXPANDER SECTION MAY BE USED ONLY IN VERTICAL RUN.
5. THE EXPANDER SECTION SHALL BE OF ADEQUATE LENGTH (ATLEAST 3–4 TIMES DIA OF THE MAIN PROCESS PIPE AT BOTH SIDE OF THE INSTALLED THERMOWELL).

FOR TENDER PURPOSE ONLY

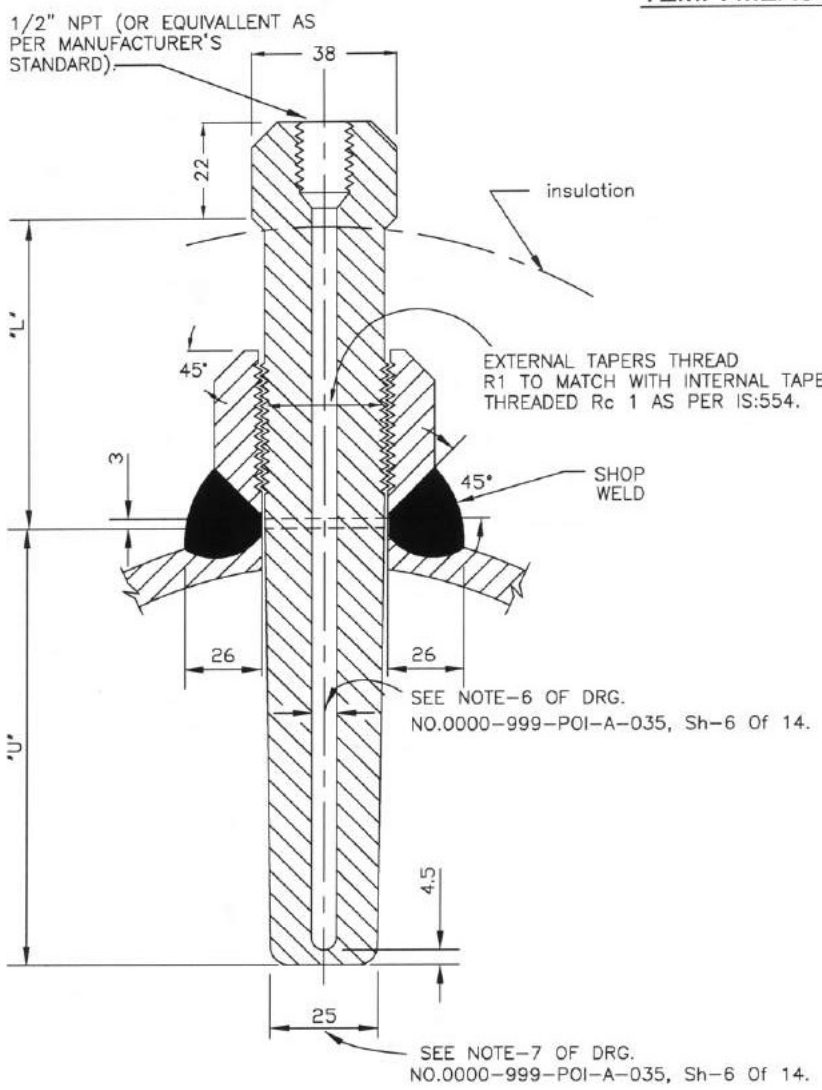
NTPC — **N T P C LIMITED** (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD.	DATE
A	FIRST ISSUE							T.G.			21.06.13

CLEARED BY

PROJECT	TYPICALTHERMAL POWER PROJECT (SG PACKAGE)			
TITLE	INSTRUMENT SOURCE CONNECTION DETAILS			
SIZE A4	SCALE N.T.S.	DRG. NO. 0000-999/102-POI-A-035 Sh–4 Of 14	REV. NO. A	

TEMP. MEASUREMENT



NOTES:-

1. THIS TYPE OF TEMPERATURE BOSS IS APPLICABLE FOR THE PROCESS PRESSURE/TEMPERATURE BELOW 40 Kg/Cm2(g)/400°C
2. FOR PRESSURE TIGHT JOINTS THE BOSS SHOULD HAVE INTERNAL TAPERED PIPE THREAD Rc 1 AS PER IS:554. THE LENGTH OF THREAD ENGAGEMENT SHOULD BE AS PER ABOVE STANDARD.
3. PIPES HAVING PROBABILITY OF PROLONGED VIBRATION SEAL WELDING MAY BE DONE ALL AROUND AFTER TIGHTENING THERMOWELL WITHIN THE BOSS.
4. SEE NOTES-2 TO 14 OF DRG. NO. 0000-999-POI-A-035, Sh-6 Of 14.

FOR TENDER PURPOSE ONLY

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

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-7 Of 14	A

	TECHNICAL SPECIFICATION MISC. PUMPS (HORIZONTAL) 2X800 MW LARA STPP STAGE-II	PE-TS-508-100-W001 Rev. No. 00 Date : 25.04.25

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 for M = motor efficiency 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 (HORIZONTAL) 2X800 MW LARA STPP STAGE-II	PE-TS-508-100-W001 Rev. No. 00
	SCHEDULE OF PERFORMANCE GUARANTEES	Date : 25.04.25

Following parameters are guaranteed for following pumps

Sl. No.	Pump Description	Guaranteed Capacity	Guaranteed TDH	Guaranteed Pump Eff.	Guaranteed Motor Eff.	Guaranteed Power consumption at inlet to motor terminals	Motor Rating	Motor GD^2 Value for HT motor only	Pump RPM	T/S Curve attached for HT motor
		(M3/Hr)	(MWC)	%	%	(KW)	(KW)			
	Horizontal pumps									
1	#DMCW TG PUMPS	1100	35		95.8					
2	#DMCW SG PUMPS	950	41		95.8					
3	#ACW PUMPS	2600	14		95.8					
4	BOILER FILL PUMPS	200	150					NA		NA
5	Condensate transfer PUMPS	300	75					NA		NA
6	#DM MAKE UP PUMPS	150	75					NA		NA
7	#CW MAKE UP PUMPS	1860	10					NA		NA
8	#SERVICE WATER PUMPS	255	60					NA		NA
9	#HVAC MAKE UP PUMPS	100	85					NA		NA
10	APH/ ESP WASH PUMPS	840	90		96					
11	#FGD GUPSUM WASH PUMPS	60	20					NA		NA
12	FGD PROCESS WATER PUMPS	450	35					NA		NA

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

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

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 15Minutes):

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.

बी एच ई एल BHEL	TECHNICAL SPECIFICATION MISC. PUMPS (HORIZONTAL) 2X800 MW LARA STPP STAGE-II	PE-TS-508-100-W001 Rev. No. 00 Date : 25.04.25

QUALITY PLAN

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.

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	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	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 **			REMARKS
										M	B	C	
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	69 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 ** M	AGENCY ** B	AGENCY ** C	REMARKS
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

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
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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	70		Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	QUALITY PLAN		SPEC NO.:PE-TS-999-100-W001	DATE	
BHEL		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 3 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								
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	

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	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 4 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								
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	Name		Sign & Date	Name	Sign & Date		Doc No:			
Prepared by:	Prashant Agarwal	PRASHANT AGARWAL	Checked by:	Gaurav Garg	GAURAV GARG	72 Seal		Reviewed by:			
Reviewed & Approved by:	Vishal Kumar Yadav	VISHAL KR. YADAV	Reviewed by:	HARISH KUMAR	HARISH KUMAR			Approved by:			

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														

ANNEXUE IV

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

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

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

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

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

LEGENDS:

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

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

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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

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 60079-1/ 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												

QP FOR MOTORS ABOVE 50 KW

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.

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 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. Pump Suction Pressure indicated in TECHNICAL DATA PART-A (+) 2 times the TDH (Total Dynamic Head) at rated capacity (or)
b. Pump Suction Pressure indicated in TECHNICAL DATA PART-A (+) 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.

SUB VENDOR LIST

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 procedure.

Package	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 (HORIZONTAL) 2X800 MW LARA STPP STAGE-II	PE-TS-508-100-W001 Rev. No. 00 Date : 25.04.25

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 (HORIZONTAL) 2X800 MW LARA STPP STAGE-II	PE-TS-508-100-W001
		Rev. No. 00
	BOQ SCHEDULE	Date : 25.04.25

1.0	**Supply of Pumps and Motors:**	**UOM**	**QUANTITY**
1.1	**DMCW TG PUMPS**		
1.1.1	Pump	Nos.	6
1.1.2	Motor	Nos.	by BHEL
1.1.3	Suction Strainer	Nos.	6
1.1.4	Mandatory Spares (as per S.No. 3.0 below)	Lot	1
1.2	**DMCW SG PUMPS**		
1.2.1	Pump	Nos.	6
1.2.2	Motor	Nos.	by BHEL
1.2.3	Suction Strainer	Nos.	6
1.2.4	Mandatory Spares (as per S.No. 3.0 below)	Lot	1
1.3	**ACW PUMPS**		
1.3.1	Pump	Nos.	6
1.3.2	Motor	Nos.	by BHEL
1.3.3	Mandatory Spares (as per S.No. 3.0 below)	Lot	1
1.4	**BOILER FILL PUMPS**		
1.4.1	Pump	Nos.	2
1.4.2	Motor	Nos.	2
1.4.3	Suction Strainer	Nos.	2
1.4.4	Mandatory Spares (as per S.No. 3.0 below)	Lot	1
1.5	**CONDENSATE TRANSFER PUMPS**		
1.5.1	Pump	Nos.	2
1.5.2	Motor	Nos.	2
1.5.3	Suction Strainer	Nos.	2
1.5.4	Mandatory Spares (as per S.No. 3.0 below)	Lot	1
1.6	**DM MAKEUP PUMPS**		
1.6.1	Pump	Nos.	3
1.6.2	Motor	Nos.	3
1.6.3	Suction Strainer	Nos.	3
1.6.4	Mandatory Spares (as per S.No. 3.0 below)	Lot	1
1.7	**CW MAKE UP PUMPS**		
1.7.1	Pump	Nos.	3
1.7.2	Motor	Nos.	3
1.7.3	Mandatory Spares (as per S.No. 3.0 below)	Lot	1
1.8	**SERVICE WATER PUMPS**		
1.8.1	Pump	Nos.	3
1.8.2	Motor	Nos.	3
1.8.3	Mandatory Spares (as per S.No. 3.0 below)	Lot	1
1.9	**HVAC MAKE UP PUMPS**		
1.9.1	Pump	Nos.	2
1.9.2	Motor	Nos.	2
1.9.3	Mandatory Spares (as per S.No. 3.0 below)	Lot	1
1.10	**APH/ ESP WASH PUMPS**		
1.10.1	Pump	Nos.	2
1.10.2	Motor	Nos.	by BHEL
1.10.3	Mandatory Spares (as per S.No. 3.0 below)	Lot	1
1.11	**FGD GYPSUM WASH PUMPS**		
1.11.1	Pump	Nos.	2

	TECHNICAL SPECIFICATION MISC. PUMPS (HORIZONTAL) 2X800 MW LARA STPP STAGE-II	PE-TS-508-100-W001 Rev. No. 00	
	BOQ SCHEDULE	Date : 25.04.25	
1.11.2	Motor	Nos.	2
1.11.3	Mandatory Spares (as per S.No. 3.0 below)	Lot	1
1.12	**FGD PROCESS WATER PUMPS**		
1.12.1	Pump	Nos.	1
1.12.2	Motor	Nos.	1
1.12.3	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 & shall be supplied with the pump.			
2.0	**SITE SERVICES:**	**UOM**	**QUANTITY**
2.1	Installation Check (For all Pumps) & Supervision for replacement of Gland packing with Mechanical Seal (for DMCW TG-Aux's Pumps, DMCW SG-Aux's Pumps, DM Make-up Pumps, Boiler Fill Pumps and Condensate Transfer Pumps) at Site as per Specification		
2.1.1	Site Visit Charges	Nos. of Visits	30
2.1.2	Manday Charges at Site	Nos. of Mandays	90
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	**DMCW TG-AUX'S PUMPS**		
3.1.1	Shaft Sleeve (DE & NDE)	2.00	SET
3.1.2	Shaft	1.00	SET
3.1.3	Impeller	1.00	SET
3.1.4	Casing & impeller Wearing Ring	2.00	SET
3.1.5	Bearings for Pumps	2.00	SET
3.1.6	Thrust Bearings (if applicable)	2.00	SET
3.1.7	Sleeve nuts and O-rings	2.00	SET
3.1.8	Fasteners	1.00	SET
3.1.9	Complete Coupling (Pump & Motor)	1.00	SET
3.1.10	Mechanical seal (both DE and NDE) if applicable	2.00	SET
3.1.11	RTD's (1 no. of each type)	1.00	SET
3.2	**DMCW SG-AUX'S PUMPS**		
3.2.1	Shaft Sleeve (DE & NDE)	2.00	SET
3.2.2	Shaft	1.00	SET
3.2.3	Impeller	1.00	SET
3.2.4	Casing & impeller Wearing Ring	2.00	SET
3.2.5	Bearings for Pumps	2.00	SET
3.2.6	Thrust Bearings (if applicable)	2.00	SET

3.2.7	Sleeve nuts and O-rings		2.00	SET
3.2.8	Fasteners		1.00	SET
3.2.9	Complete Coupling (Pump & Motor)		1.00	SET
3.2.10	Mechanical seal (both DE and NDE) if applicable		2.00	SET
3.2.11	RTD's (1 no. of each type)		1.00	SET
3.3	**ACW PUMPS**			
3.3.1	Shaft Sleeve (DE & NDE)		2.00	SET
3.3.2	Shaft		1.00	SET
3.3.3	Impeller		1.00	SET
3.3.4	Casing & impeller Wearing Ring		2.00	SET
3.3.5	Bearings for Pumps		2.00	SET
3.3.6	Thrust Bearings (if applicable)		2.00	SET
3.3.7	Sleeve nuts and O-rings		2.00	SET
3.3.8	Fasteners		1.00	SET
3.3.9	Complete Coupling (Pump & Motor)		1.00	SET
3.3.10	Mechanical seal (both DE and NDE) if applicable		2.00	SET
3.3.11	RTD's (1 no. of each type)		1.00	SET
3.4	**DM MAKE-UP PUMPS**			
3.4.1	Impeller for each type		1.00	SET
3.4.2	Wearing rings – Impeller for each type (if applicable)		1.00	SET
3.4.3	Wearing rings – Casing for each type (if applicable)		1.00	SET
3.4.4	Shaft for each type		1.00	SET
3.4.5	Shaft Sleeves for each type		1.00	SET
3.4.6	Stuffing box for each type		1.00	SET
3.4.7	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards		1.00	SET
3.4.8	Pump bearings for each type		1.00	SET
3.4.9	Gland, Packing & Gland Assembly for each type		1.00	SET
3.4.10	Motor and Motor Bearings of each type		1.00	SET
3.5	**BOILER FILL PUMPS**			
3.5.1	Impeller for each type		1.00	SET
3.5.2	Wearing rings – Impeller for each type (if applicable)		1.00	SET
3.5.3	Wearing rings – Casing for each type (if applicable)		1.00	SET
3.5.4	Shaft for each type		1.00	SET
3.5.5	Shaft Sleeves for each type		1.00	SET
3.5.6	Stuffing box for each type		1.00	SET
3.5.7	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards		1.00	SET
3.5.8	Pump bearings for each type		1.00	SET
3.5.9	Gland, Packing & Gland Assembly for each type		1.00	SET
3.5.10	Motor and Motor Bearings of each type		1.00	SET
3.6	**CONDENSATE TRANSFER PUMPS**			
3.6.1	Impeller for each type		1.00	SET
3.6.2	Wearing rings – Impeller for each type (if applicable)		1.00	SET

3.6.3	Wearing rings – Casing for each type (if applicable)		1.00	SET
3.6.4	Shaft for each type		1.00	SET
3.6.5	Shaft Sleeves for each type		1.00	SET
3.6.6	Stuffing box for each type		1.00	SET
3.6.7	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards		1.00	SET
3.6.8	Pump bearings for each type		1.00	SET
3.6.9	Gland, Packing & Gland Assembly for each type		1.00	SET
3.6.10	Motor and Motor Bearings of each type		1.00	SET
3.7	**CW MAKE UP PUMPS**			
3.7.1	Impeller for each type		1.00	SET
3.7.2	Wearing rings – Impeller for each type (if applicable)		1.00	SET
3.7.3	Wearing rings – Casing for each type (if applicable)		1.00	SET
3.7.4	Shaft for each type		1.00	SET
3.7.5	Shaft Sleeves for each type		1.00	SET
3.7.6	Stuffing box for each type		1.00	SET
3.7.7	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards		1.00	SET
3.7.8	Pump bearings for each type		1.00	SET
3.7.9	Gland, Packing & Gland Assembly for each type		1.00	SET
3.7.10	Motor and Motor Bearings of each type		1.00	SET
3.8	**SERVICE WATER PUMPS**			
3.8.1	Impeller for each type		1.00	SET
3.8.2	Wearing rings – Impeller for each type (if applicable)		1.00	SET
3.8.3	Wearing rings – Casing for each type (if applicable)		1.00	SET
3.8.4	Shaft for each type		1.00	SET
3.8.5	Shaft Sleeves for each type		1.00	SET
3.8.6	Stuffing box for each type		1.00	SET
3.8.7	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards		1.00	SET
3.8.8	Pump bearings for each type		1.00	SET
3.8.9	Gland, Packing & Gland Assembly for each type		1.00	SET
3.8.10	Motor and Motor Bearings of each type		1.00	SET
3.9	**HVAC MAKE UP PUMPS**			
3.9.1	Impeller for each type		1.00	SET
3.9.2	Wearing rings – Impeller for each type (if applicable)		1.00	SET
3.9.3	Wearing rings – Casing for each type (if applicable)		1.00	SET
3.9.4	Shaft for each type		1.00	SET
3.9.5	Shaft Sleeves for each type		1.00	SET
3.9.6	Stuffing box for each type		1.00	SET
3.9.7	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards		1.00	SET
3.9.8	Pump bearings for each type		1.00	SET

	TECHNICAL SPECIFICATION MISC. PUMPS (HORIZONTAL) 2X800 MW LARA STPP STAGE-II		PE-TS-508-100-W001 Rev. No. 00	
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3.9.9	Gland, Packing & Gland Assembly for each type		1.00	SET
3.9.10	Motor and Motor Bearings of each type		1.00	SET
3.10	**APH/ ESP WASH PUMPS**			
3.10.1	Impeller for each type		1.00	SET
3.10.2	Wearing rings – Impeller for each type (if applicable)		1.00	SET
3.10.3	Wearing rings – Casing for each type (if applicable)		1.00	SET
3.10.4	Shaft for each type		1.00	SET
3.10.5	Shaft Sleeves for each type		1.00	SET
3.10.6	Stuffing box for each type		1.00	SET
3.10.7	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards		1.00	SET
3.10.8	Pump bearings for each type		1.00	SET
3.10.9	Gland, Packing & Gland Assembly for each type		1.00	SET
3.10.10	RTD's (1 no. of each type)		1.00	SET
3.11	**FGD GYPSUM WASH PUMPS**			
3.11.1	Impeller for each type		1.00	SET
3.11.2	Wearing rings – Impeller for each type (if applicable)		1.00	SET
3.11.3	Wearing rings – Casing for each type (if applicable)		1.00	SET
3.11.4	Shaft for each type		1.00	SET
3.11.5	Shaft Sleeves for each type		1.00	SET
3.11.6	Stuffing box for each type		1.00	SET
3.11.7	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards		1.00	SET
3.11.8	Pump bearings for each type		1.00	SET
3.11.9	Gland, Packing & Gland Assembly for each type		1.00	SET
3.11.10	Motor and Motor Bearings of each type		1.00	SET
3.12	**FGD PROCESS WATER PUMPS**			
3.12.1	Impeller for each type		1.00	SET
3.12.2	Wearing rings – Impeller for each type (if applicable)		1.00	SET
3.12.3	Wearing rings – Casing for each type (if applicable)		1.00	SET
3.12.4	Shaft for each type		1.00	SET
3.12.5	Shaft Sleeves for each type		1.00	SET
3.12.6	Stuffing box for each type		1.00	SET
3.12.7	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards		1.00	SET
3.12.8	Pump bearings for each type		1.00	SET
3.12.9	Gland, Packing & Gland Assembly for each type		1.00	SET
3.12.10	Motor and Motor Bearings of each type		1.00	SET

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.

	TECHNICAL SPECIFICATION MISC. PUMPS (HORIZONTAL) 2X800 MW LARA STPP STAGE-II	PE-TS-508-100-W001
		Rev. No. 00
	BOQ SCHEDULE	Date : 25.04.25
2	In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities as specified in the Technical specification.	

बी एच ई एल BHEL	TECHNICAL SPECIFICATION MISC. PUMPS (HORIZONTAL) 2X800 MW LARA STPP STAGE-II	PE-TS-508-100-W001 Rev. No. 00 Date : 25.04.25

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 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, PERFORMACE CURVES, GENERAL ARRANGEMENT AND CROSS SECTIONAL - MISC. PUMPS (H)	Rev-00 to be submitted within 25 days of LOI/PO date.
2	TDS AND CURVES OF MOTORS FOR MISC. PUMPS (H)	
3	QP-MISC PUMPS (H)	
4	QP- MOTORS	
5	MOTOR TYPE TEST DOC - If Applicable	Rev-00 to be submitted within 15 days of approval of documents at S.No. 2 & 4 above.
6	O & M MANUAL - MISC PUMPS (H)	Rev-00 to be submitted within 15 days of approval of above documents.
7	PG TEST PROCEDURE - MISC PUMPS (H) - If Applicable	
BHEL/Customer comments/approval and Vendor Re-submission schedule		
BHEL comments on First Submission		Within 10 days of Vendor submission.

	TECHNICAL SPECIFICATION MISC. PUMPS (HORIZONTAL) 2X800 MW LARA STPP STAGE-II	PE-TS-508-100-W001 Rev. No. 00 Date : 25.04.25

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 strainer drawing) should include foundation base plate/sole plate details as applicable, civil foundation, anchor bolt details, loading data (Static and Dynamic), points of connections of external piping, cables and mounting of devices furnished by the supplier and details for Gap between Coupling Shafts, Float & details for axial/radial tolerance allowed etc. which are required for erecting agency during erection of pump.
2	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

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

बी एच ई एल BHEL	TECHNICAL SPECIFICATION MISC. PUMPS (HORIZONTAL) 2X800 MW LARA STPP STAGE-II	PE-TS-508-100-W001 Rev. No. 00 Date : 25.04.25

PRE QUALIFICATION REQUIREMENT (TECHNICAL)

FORM NO. PEM 6100-0

	PRE - QUALIFYING REQUIREMENTS (TECHNICAL)	TECHNICAL SPECIFICATION NO- PE-TS-508-100-W001, Rev-00 TECHNICAL PQR NO. PE-PQ-508-100-W111 REV NO.: 00 DATED- 25.04.2025
		STANDARD PQR NO: PE-PQ-STD-100-N111 REVISION NO: 04 DATE: 07.02.2020
		SHEET: 1 of 2

ENQUIRY NO:

PROJECT: 2X800 MW LARA STPP STAGE-II

PACKAGE: MISC. PUMPS (HORIZONTAL)

1. The bidder should have designed, manufactured, tested, inspected & supplied the Horizontal Centrifugal pumps for water application with minimum rated flow of 2300 m3/hr , which have been successfully in use for at least 1 year in two different thermal power plants or similar industry/ application and bidder is in business of Horizontal centrifugal pumps for water application on continuous basis.

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

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

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

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

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

OR

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

OR

iii. Satisfactory Performance feedback certificates from End Customer (Owner) (in English) for one successfully executed contract which have been successfully in use for atleast one

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

AND

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

Notes: -

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

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

a. Tax Invoice.

b. Site receipt/Receipted LR.

c. Customer's material dispatch clearance certificate.

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

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

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

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

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

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.

ANNEXURE-1

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:-