GUJARAT STATE ELECTRICITY CORPORATION LTD

1X800 MW WANAKBORI SUPERCRITICAL THERMAL POWER PROJECT

VOLUME – II – B & III

TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT

SPECIFICATION NO.: PE-TS-408-155-A001 REV 0

BHARAT HEAVY ELECTRICALS LIMITED

POWER SECTOR

PROJECT ENGINEERING MANAGEMENT

NOIDA, INDIA

VOLUME – IIB

VOLUME-III

SECTION-A

INTENT OF SPECIFICATION

1.0 INTENT OF SPECIFICATION

1.1 The specification covers design, engineering, manufacture, fabrication, assembly, inspection & testing at vendor's & sub-vendor's works, painting, forwarding, supply and delivery at site including start up and commissioning spares, mandatory spares, properly packed for transportation, unloading / handling and storage at site, in site transportation, assembly, erection and commissioning, trail run, preparation and submission of "As Built" drawings, site testing, carrying out performance guarantee tests at site and handover of **Condensate Polishing Unit and external regeneration system** as per the details in different sections / volumes of this specification for **1X800 MW WANAKBORI STPP.**

1.2 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve the contractor of the responsibility of providing such facilities to complete the supply, erection and commissioning, performance and guarantee testing of **Condensate Polishing Unit and external regeneration system**.

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

1.4 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.

1.5 The general term and conditions, instructions to tenderers and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification is subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.

1.6 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Vol-III of the specification **within 10 days of receipt of tender documents.** In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser / Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such

requirements shall be binding on the successful bidder without any commercial & delivery implication.

1.7 The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.

1.8 Deviations, if any, should be very clearly brought out clause by clause along with cost of withdrawal in the enclosed schedule (in Vol – III); otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification. If no cost of withdrawal is given against the deviation, it will be presumed that deviation can be withdrawn without any cost to BHEL/its customer.

1.9 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.

1.10 For definition of word like Contractor, bidder, supplier, vendor, Customer/ Purchaser / Employer, consultant, please referred relevant clause(s) of GCC.

SECTION-B

PROJECT INFORMATION

VOLUME : IIA

SECTION-II

PROJECT SYNOPSIS AND GENERAL INFORMATION

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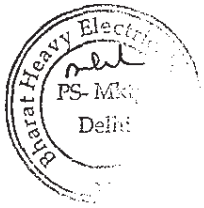

VOLUME : IIA

SECTION-II

PROJECT SYNOPSIS AND GENERAL INFORMATION

1.00.00 INTRODUCTION

The proposed 1x800 MW Supercritical Thermal Power Project would be set up by Gujarat State Electricity Corporation Limited (GSECL) at Kheda district of Gujarat.

The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given here in under is for general guidance and shall not be contractually binding on the Owner. All relevant site data /information as may be necessary shall have to be obtained /collected by the Bidder.

2.00.00 APPROACH TO SITE

The proposed site is located in Kheda district about 13 kilometers from the nearest commercial town of Balasinor & 10 kilometers from Sevalia town. The National Highway, NH-08, connecting Dakor – Godhra is about 10 kilometers from the site. The State Highway SH – 59 connecting Balasinor – Sevalia is about 2 Kilometers from the site. Nearest railway station to the existing site is Sevalia, located about 8 kilometers from the site on Anand – Godhara main broad gauge line of Western Railway.

Nearby Air Ports are Ahmedabad at a distance of about 110 kilometers from the site and Vadodara at a distance of about 85 kilometers from the site.

3.00.00 LAND

The proposed extension unit will be developed in the existing Wanakbori Thermal Power Station and will be located north east side of the existing plot in the Kheda District of Gujarat. The land of the proposed plant will be filled in upto a desired level. Existing Ash Pond/ Dyke area will be utilized for the extension unit.

4.00.00 SOURCE OF COAL

Indian coal would be sourced from captive mines Machha Kata in Talcher, State – Orissa which are situated about 1800 Kms from the project site. GSECL will arrange for transportation of the coal required for the extension unit from these captive mines by the existing railway facilities for delivery of coal supply to the Wanakbori power station.

CONTENT

5.00.00 **SOURCE OF WATER**

The water required for the new unit shall be obtained from River Mahi, flowing by the side of the existing Wanakbori Power Station.

One (1) new jackwell will be installed on Mahi river for supply of water for new plant. In addition, existing Canal Water and Jackwell Water will have interconnection with new plant to cater plant water requirement of new plant.

6.00.00 **ASH DISPOSAL AREA**

Existing Ash Pond / Dyke area will be utilized for the extension unit. Fly ash silos will be located outside plant boundary wall (but within GSECL land) in the vicinity of the Ash Dyke area.

7.00.00 **SALIENT DESIGN DATA**

7.01.00 Meteorological data of site is given below:-

Elevation above MSL	:	72 M
Max. daily average temp	:	34 °C
Min. daily average temp	:	11.7 °C
Max. Ambient air temp. (daily)	:	34°C
Max. Ambient air temp. (yearly)	:	30°C
Max. Ambient air temp.	:	42°C
Wet bulb temperature	:	28°C
Relative Humidity	:	RH varies within a range from 50% to 95%.
Average annual rainfall	:	750 mm

[Metrological data of Vadodara is attached for reference].

Gujarat State Electricity Corpn. Ltd. GSECL P&P Vadodara

Bharat Heavy Electricals Limited PS-Mktg. Delhi

VOLUME : IIA

SECTION-IX

SALIENT DESIGN DATA

[TABLE-I TO TABLE-VII]

CONTENT

TABLE-I

CLARIFIED WATER ANALYSIS

(As Received)

CONSTITUENTS	As	CONTENT	Jan-March	April-June	July-Sept	Oct-Dec
Calcium Hardness	CaCO3	ppm	70	62	57	64
Magnesium Hardness	CaCO3	ppm	63	78	52	65
Sodium + Potassium	CaCO3	ppm	-	-	-	-
Iron in Solution.	CaCO3	ppm	0.032	0.030	0.025	0.032
Manganese in Solution	CaCO3	ppm	-	-	-	-
Hydrogen (FMA)	CaCO3	ppm	64	68	36	40
TOTAL CATIONS	CaCO3	ppm	180	197	147	165
Bicarbonate	CaCO3	ppm	137	145	105	123
Carbonate	CaCO3	ppm	0	0	0	0
Hydroxide	CaCO3	ppm	-	-	-	-
Sulphate	CaCO3	ppm	14	16	18	14
Chloride	CaCO3	ppm	29	35	24	28
Nitrate	CaCO3	ppm	-	-	-	-
Fluoride	CaCO3	ppm	-	-	-	-
TOTAL ANIONS	CaCO3	ppm	200	215	160	185
Colloidal Silica	SiO_2	ppm	-	-	-	-
Dissolved Silica	SiO_2	ppm	18	16	12	20
Conductivity at 25^{0}C	-	Micro siemens/cm (maximum)	367	400	302	321
pH value at 25^{0}C	-		7.87	7.76	7.71	7.75
Total Suspended solids	-	ppm (maximum)	294	320	242	257
Turbidity		NTU (maximum)	2	2	5	2

TABLE-I

CLARIFIED WATER ANALYSIS

CONSTITUENTS	As	CONTENT
Calcium	$CaCO_3$	85.0 ppm
Magnesium	$CaCO_3$	94.0 ppm
Sodium + Potassium	$CaCO_3$	75.0 ppm
	$CaCO_3$	
Iron in Solution.	Fe	0.05 ppm
Hydrogen (FMA)	$CaCO_3$	- ppm
TOTAL CATIONS (except iron)	CaCO3	254.0 ppm
Bicarbonate	$CaCO_3$	160.0 ppm
Carbonate	$CaCO_3$	- ppm
Hydroxide	$CaCO_3$	- ppm
Sulphate	$CaCO_3$	20.0 ppm
Chloride	$CaCO_3$	52.0 ppm
Nitrate	$CaCO_3$	22.0 ppm
Phosphate		- ppm
Fluoride	$CaCO_3$	0.0 ppm
TOTAL ANIONS	$CaCO_3$	254.0 ppm
Reactive Silica	SiO_2	22.0 ppm
Colloidal Silica	SiO_2	0.0 ppm
Conductivity at 25^{0}C	-	440 Micro siemens/cm (maximum)
pH value at 25^{0}C	-	7.5 – 8.0
Turbidity		Not to exceed 15 NTU (maximum)

Notes:

1) The Cycle of Concentration of Cooling water shall be 5.0. Bidder to derive the Cooling water analysis accordingly and design the Condensate Polishing Unit for Condenser tube leakage condition accordingly.
2) The above clarified water analysis shall be used to design the Condensate Polishing Unit for Condenser tube leakage condition.

TABLE-II

RAW WATER ANALYSIS
(As Received)

Source : River Mahi (Jack-well/ canal)

(1) Jack-well/Canal Water Parameters

Sl. No.	Parameter	Unit	Result
1	pH	Unit	8.42
2	Turbidity	NTU	2.2
3	Conductivity	µMhos/cm	440
4	Total alkalinity as $CaCO_3$	ppm	152
5	Chloride as Cl	ppm	33
6	Total hardness as $CaCO_3$	ppm	134
7	Calcium Hardness as $CaCO_3$	ppm	52
8	Magnesium Hardness as $CaCO_3$	ppm	82
9	Silica as SiO_2	ppm	20
10	Total Dissolved solids as such	ppm	308.42
11	Sulphate as SO_4	ppm	12
12	Iron as Fe	ppm	0.031
13	Potassium		Not present
14	TSS	ppm	1-2

(2) Hypothetical Combination of Ions

Sl. No.	Parameter	As	CONTENT ppm
1	Calcium Hardness	$CaCO_3$	52
2	Magnesium Hardness	$CaCO_3$	82
3	Sodium	$CaCO_3$	79
4	Iron in Solution.	Fe	-
5	Manganese in solution	$CaCO_3$	-
6	Total Cations	$CaCO_3$	213
7	Bicarbonate	$CaCO_3$	152
8	Carbonate	$CaCO_3$	2
9	Hydroxide		-
10	Sulphate	SO_4	12.5
11	Chloride	$CaCO_3$	46.48
12	Nitrate	NO3	-
12	Fluoride	-	-
13	Total Anions	-	213

TABLE-III

ESTIMATION OF CONSUMPTIVE WATER REQUIREMENT

Sl. No.	Consumption Points	DM Water (m3/hr)	Filtered Water (m3/hr)	Clarified Water (m3/hr)	Raw Water (m3/hr)	REMARKS
1.	a. Heat Cycle Make-up b. Make-up Requirement for DMCW System c. Chemical Feed System d. Condensate Polishing Unit e. Neutralisation Pit	72* 0.5 0.5 4 6				**Note: Heat Cycle Make-up is 3% of BMCR steam flow.*
	Sub-Total (a to e)	**83**	**83**			
2.	a. Potable Water Requirement b. Backwash of Filter		2 2			
	Sub-Total (1 + 2)		**87**	**87**		
3.	a. Ventilation System Requirement b. AC Plant Requirement c. Fire Water System d. AHP Gland Sealing System e. Backwash Return			17 10 - 90 (-) 2		C.O.C : 5 CTBD : 372
	Sub-Total (1 + 2 + 3)			**202**	**202**	
4.	a. Service Water b. CT Make-up requirement				25 1884	
	GRAND TOTAL (1 to 4)				**2111**	**(Say 21.0 Cusec)**

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TABLE-IV

ANALYSIS OF COAL

PROXYMATE ANALYSIS

No.	Description	Designed Coal	Worst Coal
1.	Fixed Carbon	28.83%	26%
2.	Volatile Matter (VM)	26.61%	22.00%
3.	Moisture	10.80%	10.0%
4.	Ash	33.76%	42.00%
5.	Gross calorific value	3850 Kcal/kg	3500 Kcal/kg

ULTIMATE ANALYSIS

No.	Description	Designed Coal	Worst Coal
1.	Carbon	40.34%	35.87%
2.	Hydrogen	2.61%	2.66%
3.	Sulphur	0.80%	0.90%
4.	Nitrogen	0.97%	0.72%
5.	Oxygen (by diff.)	10.72%	7.85%
6.	Moisture	10.8%	10%
7.	Ash	33.76%	42.00%
8.	Grindability Index (HGI)	66	50
9.	Ash Fusion Temperature (deg C) (IDT)	1350	1160

TABLE-V

ASH ANALYSIS
(As Received)

Sl. No.	Characteristic	Result
1.	Silicon dioxide (SiO2) plus Aluminium Oxide (Al203) plus Iron Oxide (Fe203) present by mass Min.	93.3 – 95.7
2.	Silicon dioxide (SiO2), percent by mass Min.	58.4 – 63.0
3.	Total sulphur as sulphur trioxide (SO3) percent by mass Max.	0.31 – 0.76
4.	Available alkalis as sodium Oxide (Na2O) in percent by mass Max.	Nil
5.	Loss on ignition, in percent by mass Max.	0.31 – 0.87
6.	Moisture content %	0.026 – 0.132
7.	Ash fusion temp. (Deg C) (IDT)	1350 / 1160
8.	Hemispherical (Deg C)	1400
9.	Fusion temp. (Deg C)	1400
10.	Lead (as pb)	0.14 µg/g
11.	Arsenic (as As)	0.01 µg/g
12.	Mercury (as Hg)	0.04 µg/g

Gujarat State Electricity Corpn. Ltd. PSP Vadodara

Bharat Heavy Electricals Limited PS- Mktg. Delhi

TABLE-VI

FUEL OIL ANALYSIS

Sl. No.	Parameters	Unit	LDO	LSHS	HSD
1.0	Density at 15 degC	gm/l	0.8682	0.9708	0.8297
2.0	Water Content	%v/v	0.15	0.10	0.05
3.0	Sediment	%w/w	0.06	0.04	0.02
4.0	Total Sediment	mg/100ml	——	——	0.94
5.0	Redwood Vis. 37.8	Second	30.0	——	——
6.0	Kinematics Vis 38	cst	6.80	——	——
7.0	Kinematics Vis 100 C	cst	——	68.00	——
8.0	Kinematics Vis 40 C	cst	——	——	2.08
9.0	Flash Point (PMCC)	Deg. C	75	>93	41
10.0	Pour Point	Deg. C	9	27	6
11.0	Acidity -Inorganic	mg KOH/g	Nil	——	Nil
12.0	Acidity -Total	mg KOH/g	——	——	0.13
13.0	Ash	%wt	0.01	0.01	——
14.0	Sulphur Cont. Total	%Mass	0.46	1.14	0.11
15.0	C RES RAMSBOTT. MTD	%Mass	0.53	——	0.21
16.0	Smoke Point	Mm	7.00	——	——
17.0	Gross C.V	Kcal/Kg	——	——	——

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TABLE-VI

FUEL OIL ANALYSIS – FURNACE OIL FO

Sl. No.	Parameters	Unit	FO
1.0	Acidity –Inorganic in mg. KOH/g	mg. KOH/g	0.0000
2.0	Ash	Wt%	0.059
3.0	Density at 15 degC	Kg/m^3	954.8
4.0	Flash Point (PMCC)	Cell	69.0
5.0	Calorific Value Net in	Kcal / Kg	9818
6.0	Gross Calorific Value	Kcal/kg.	10402
7.0	Water Content	Vol%	0.20
8.0	Kinematics Viscosity @50°C summer	cst	134.0
9.0	Pour Point Summer	Cel	18.0
10.0	Sediment	Wt%	0.10
11.0	Sulphur Total	Wt%	0.680

TABLE-VII
CLIMATOLOGICAL TABLE OF BARODA

STATION : Baroda 42747 LAT: 22 18 N LONG: 73 15 E HT. ABOVE M.S.L. 34 METERS DATA 1951 TO 1980

		Mean Temperature		Extremes						Cloud		Rainfall					
MN	SLP	DB	WB	MAX	MIN	HIGH	LOW	MAX DT	MIN DT	RH VP	TOT LOW	TOT	RAINY	WET	DRY	HEAVY	DAY	WS
1	1011.8	13.8	10.9	30.3	12.0	34.3	7.5	36.2 25	-1.1 15	67 10.7	1.1 0.3	1.2	0.1	53.6	0.0	33.0	05	4.0
	1008.5	27.9	17.8					1961	1935	33 12.4	1.1 0.1			1920			1920	
2	1010.3	16.2	12.3	33.0	13.8	37.9	8.9	41.7 28	1.7 10	61 11.2	0.9 0.2	0.6	0.1	33.0	0.0	33.0	10	4.1
	1006.7	31.4	18.7					1953	1950	25 11.3	0.9 0.2			1898			1898	
3	1008.5	22.1	16.3	37.1	18.4	41.5	13.1	44.4 26	6.7 03	53 13.8	1.1 0.2	2.2	0.2	44.3	0.0	21.0	23	4.2
	1004.3	35.8	20.5					1973	1936	20 11.7	1.2 0.2			1967			1967	
4	1005.9	27.3	20.7	40.2	22.9	43.9	18.4	45.9 25 *	11.7 16	53 19.2	1.1 0.2	0.9	0.1	83.3	0.0	71.4	18	4.8
	1001.4	39.1	22.5					1979	1955	20 14.1	1.2 0.2			1947			1947	
5	1003.1	29.9	24.6	40.9	26.5	44.5	23.2	46.7 11	18.9 05	64 26.8	1.7 1.2	4.4	0.3	153.9	0.0	59.7	29	8.7
	998.3	39.8	24.9					1960	1939	27 19.3	0.7 0.3			1917			1917	
6	999.4	29.3	26.0	37.1	27.0	41.5	23.5	45.6 06 *	20.2 19	76 30.9	4.5 2.9	146.8	5.6	527.8	0.0	177.4	06	10.3
	995.4	35.3	26.6					1979	1978	51 27.8	3.4 2.0			1913			1976	
7	998.1	27.4	25.8	32.7	25.7	36.9	23.5	40.6 05	21.1 19	88 31.8	6.5 4.0	297.6	13.8	899.0	4.8	247.4	24	8.4
	995.3	30.8	26.5					1962	1943	72 31.1	6.4 4.0			1950	1899		1927	
8	999.8	26.4	25.1	31.5	25.0	34.6	23.4	37.4 30	22.2 01	90 30.9	6.7 3.8	284.7	12.0	748.5	0.3	250.7	05	7.1
	997.0	29.9	26.1					1979	1976	74 30.6	6.5 3.9			1933	1899		1956	
9	1003.6	26.3	24.5	33.2	24.3	37.0	22.4	41.1 30 *	18.9 29	86 29.4	4.3 2.4	141.7	7.1	575.4	0.0	372.1	24	5.1
	1000.2	31.5	25.7					1951	1938	63 28.2	4.0 2.4			1945			1945	
10	1007.5	25.0	21.5	36.0	21.3	38.5	16.7	41.7 13	11.7 30	72 22.9	1.5 0.6	22.0	1.3	272.3	0.0	153.2	29	3.0
	1004.0	33.3	23.9					1951	1955	44 22.2	1.4 0.6			1917			1930	
11	1010.5	20.4	16.4	34.3	16.7	37.2	12.9	39.6 02	7.2 30	64 15.5	1.3 0.4	16.2	0.7	212.4	0.0	64.6	22	3.0
	1007.2	30.5	21.2					1966	1938	41 17.8	1.3 0.4			1979			1976	
12	1011.9	15.6	12.7	31.4	13.4	34.5	9.6	36.8 01	3.3 22	70 12.5	1.3 0.2	4.4	0.2	43.4	0.0	43.4	01	3.6
	1008.7	28.0	19.1					1980	1937	40 15.1	1.3 0.2			1978			1978	
YR	1005.9	23.3	19.7	34.8	20.6	44.8	6.9	46.7	-1.1	70 21.3	2.7 1.4	922.7	41.5	1666.0	133.1	372.1		5.5
LY	1002.3	32.8	22.8							43 20.1	2.5 1.2			1976	1899			
YRS	30	30	30	30	30	30	30	48	48	30 29	30 22	30	30	93	93	93		30
	30	30	30							30 29	30 22							

* Occurred More Than Once

STATION : Baroda 42747 .. contd

	Weather						Wind speed				% Wind Direction									Total Cloud					Low cloud						Visibility				
MN	PPT	HAIL	THUN	FOG	D.STM	SQUA	62	61	19	0	N	NE	E	SE	S	SW	W	NW	0	0	T-2	3-5	6-7	8	0	T-2	3-5	6-7	8	F8	<1	1-4	4-10	10-20	>20
1	0.3	0.0	0.1	0.5	0.0	0.0	0	0	19	12	13	39	2	2	1	3	1	3	36	20	5	3	2	1	28	2	1	0	0	0	0.3	1.7	2.0	25.6	1.4
							0	0	25	6	12	30	2	0	0	3	8	23	22	19	6	3	2	1	28	2	1	0	0	0	0.0	0.0	0.0	1.9	29.1
2	0.3	0.0	0.1	0.2	0.0	0.0	0	0	17	11	10	31	1	2	2	7	2	4	41	20	4	3	1	0	26	1	1	0	0	0	0.2	1.6	2.3	23.9	0.0
							0	0	24	4	10	21	2	2	0	9	12	28	16	19	5	2	2	0	25	2	1	0	0	0	0.0	0.0	0.0	1.7	26.3
3	0.2	0.0	0.2	0.0	0.0	0.0	0	0	19	12	7	15	1	3	5	16	5	7	41	20	5	4	2	0	29	1	1	0	0	0	0.0	0.5	0.7	29.8	0.0
							0	0	27	4	7	13	2	1	1	15	16	32	13	20	6	3	2	0	28	2	1	0	0	0	0.0	0.0	0.0	1.5	29.5
4	0.2	0.0	0.5	0.0	0.0	0.0	0	0	22	8	5	5	1	2	6	29	10	12	30	19	5	3	2	1	27	2	1	0	0	0	0.0	0.1	0.1	29.7	0.1
							0	0	27	3	4	4	1	0	1	20	26	35	9	16	7	3	3	1	25	4	1	0	0	0	0.0	0.0	0.0	0.3	29.7
5	0.4	0.0	0.6	0.0	0.3	0.0	0	0	28	3	1	1	1	1	5	57	17	7	10	15	6	7	3	0	19	4	6	2	0	0	0.0	0.0	0.0	30.8	0.2
							0	1	29	1	1	2	0	1	2	45	30	14	5	21	8	1	1	0	24	6	1	0	0	0	0.0	0.0	0.0	1.7	29.3
6	7.6	0.0	3.3	0.0	0.1	0.2	0	0	28	2	0	1	0	2	10	61	16	1	9	2	6	9	7	6	6	8	12	4	0	0	0.0	0.0	0.3	29.6	0.1
							0	2	27	1	0	1	0	2	7	61	21	3	5	4	9	6	6	5	8	11	8	3	0	0	0.0	0.0	0.3	1.8	27.9
7	18.8	0.0	2.1	0.0	0.0	0.1	0	0	27	4	0	0	0	1	8	62	14	0	15	0	2	5	8	16	4	4	14	8	1	0	0.0	0.0	0.2	30.8	0.0
							0	1	27	3	0	0	0	2	8	60	18	3	9	1	1	5	11	13	1	7	13	9	1	0	0.0	0.0	0.3	4.3	26.4
8	17.8	0.0	1.8	0.0	0.0	0.0	0	0	26	5	1	0	0	0	7	55	20	1	16	0	1	4	8	18	4	4	13	9	1	0	0.0	0.1	0.8	29.2	0.9
							0	1	27	3	0	1	0	1	6	55	21	4	12	0	2	5	11	13	1	7	14	8	1	0	0.0	1.1	0.4	5.0	24.5
9	10.2	0.0	2.6	0.0	0.0	0.0	0	0	23	7	2	3	0	2	5	37	18	6	27	4	6	6	6	8	12	4	8	5	1	0	0.0	0.1	0.2	29.3	0.4
							0	0	25	5	2	3	1	1	3	32	26	15	17	2	9	6	8	5	6	12	8	4	0	0	0.0	0.0	0.1	2.6	27.3
10	1.6	0.0	1.4	0.2	0.0	0.0	0	0	17	14	6	16	3	6	4	12	3	3	47	17	7	4	2	1	26	2	2	1	0	0	0.0	0.2	0.3	29.7	0.8
							0	0	20	11	9	15	3	2	1	8	10	16	36	14	11	3	2	1	20	9	2	0	0	0	0.0	0.0	0.0	0.5	30.5
11	1.1	0.0	0.3	0.2	0.0	0.0	0	0	17	13	11	33	4	3	1	2	0	1	45	18	6	3	2	1	27	1	2	0	0	0	0.1	0.3	0.4	28.3	0.9
							0	0	18	12	11	24	4	1	0	2	3	13	42	17	7	3	2	1	25	3	2	0	0	0	0.0	0.0	0.0	0.7	29.3
12	0.3	0.0	0.2	0.2	0.0	0.0	0	0	20	11	12	43	3	1	1	1	0	1	38	19	5	4	2	1	29	1	1	0	0	0	0.0	1.3	1.3	27.4	1.0
							0	0	21	10	17	24	4	1	0	2	4	16	32	17	7	3	3	1	28	2	1	0	0	0	0.0	0.0	0.0	0.6	30.4
YR	58.8	0.0	13.2	1.3	0.4	0.3	0	0	263	102	6	16	1	2	5	29	9	4	28	154	58	55	45	53	237	34	62	29	3	0	0.6	5.9	8.6	344.1	5.8
LY							0	5	297	63	6	12	2	1	2	26	16	17	18	150	78	43	53	41	219	67	53	24	2	0	0.0	1.1	1.1	22.6	340.2
YRS				26					24						29								27					27					27		
									24						29								26					26					27		

STATION : Baroda (A) 42748 LAT: 22 20 N LONG: 73 16 E HT. ABOVE M.S.L. 38 METERS DATA 1952 TO 1980

		Mean Temperature		Extremes						Cloud		Rainfall					
MN	SLP	DB	WB	MAX	MIN	HIGH	LOW	MAX DT	MIN DT	RH	VP	TOT LOW	TOT	RAINY	WET	DRY	HEAVY	DAY	WS
1	1011.5	15.2	11.3	29.4	12.2	33.4	7.2	35.8 13	2.8 22	59	10.3	1.2 0.1	1.3	0.1	15.8	0.0	14.0	07	7.6
	1008.1	27.6	17.3					1979	1962	31	11.5	1.2 0.1			1953			1953	
2	1010.0	17.8	12.4	32.1	13.9	36.6	8.8	40.6 28	3.9 10	50	10.2	1.0 0.3	0.7	0.1	11.0	0.0	6.0	02	7.6
	1006.3	30.9	17.8					1953	1950	23	9.9	1.0 0.3			1961			1961	
3	1008.1	23.2	16.5	36.4	18.2	40.5	13.0	43.9 29	9.3 08	48	13.4	1.1 0.2	1.2	0.2	21.4	0.0	11.5	25	7.5
	1003.9	35.1	20.0					1977	1979	21	11.2	1.3 0.2			1967			1967	
4	1005.6	27.8	20.8	39.5	22.8	42.9	18.2	45.9 29	14.4 15	51	19.0	1.2 0.3	0.3	0.0	8.2	0.0	8.2	25	8.3
	1000.9	38.5	21.8					1979	1955	19	12.8	1.5 0.3			1978			1978	
5	1002.7	29.9	24.6	40.3	26.5	43.7	22.9	46.1 20	19.4 27	64	26.6	1.9 1.6	3.7	0.2	50.1	0.0	40.9	29	14.6
	997.7	39.0	24.5					1955	1974	29	19.0	0.9 0.5			1974			1956	
6	999.0	29.3	26.1	36.7	26.8	40.9	23.2	45.6 06	17.1 03	77	31.0	4.9 3.4	129.7	5.0	439.0	0.0	187.3	06	18.0
	994.9	34.6	26.6					1979	1980	54	28.1	3.9 2.5			1976			1976	
7	997.7	27.4	25.8	32.4	25.6	36.2	23.5	39.6 02	22.2 28	88	32.0	6.6 4.1	290.7	12.6	605.6	60.8	162.0	11	15.2
	994.7	30.2	26.5					1968	1952	75	31.6	6.5 3.9			1976	1974		1976	
8	999.5	26.5	25.2	31.3	24.9	34.4	23.2	39.1 16	21.7 16	90	31.0	6.8 3.9	274.4	11.8	657.4	38.5	277.1	05	12.6
	996.5	29.3	26.0					1969	1956	76	30.8	6.5 3.8			1978	1974		1956	
9	1003.2	26.5	24.6	32.7	24.2	36.5	22.2	41.1 29	18.1 25	85	29.4	4.7 2.6	147.0	7.2	456.4	0.3	221.6	07	9.1
	999.7	30.9	25.4					1951	1972	65	28.1	4.5 2.6			1958	1957		1970	
10	1007.2	26.0	21.7	35.4	21.1	37.9	16.5	41.2 15	12.8 27	67	22.6	1.7 0.6	21.6	1.3	143.9	0.0	71.1	01	6.2
	1003.7	32.9	23.0					1980	1960	41	20.2	1.8 0.8			1956			1954	
11	1010.3	21.7	16.7	33.4	16.7	36.2	12.4	39.4 01	6.0 26	58	15.0	1.6 0.4	16.5	0.7	190.1	0.0	61.4	04	6.7
	1006.9	30.2	20.2					1980	1968	37	15.6	1.5 0.5			1979			1962	
12	1011.7	17.3	13.3	30.7	13.7	33.5	9.5	37.2 06	6.4 30	61	12.1	1.5 0.1	3.3	0.2	34.2	0.0	34.2	01	7.0
	1008.3	28.0	18.3					1968	1977	36	13.3	1.6 0.2			1978			1978	
YR	1005.5	24.1	19.9	34.2	20.6	44.1	6.8	46.1	2.8	67	21.1	2.9 1.5	911.1	39.4	1721.7	314.9	277.1		10.0
LY	1001.8	32.3	22.3							42	19.3	2.7 1.3			1976	1972			
YRS	29	29	29	29	29	29	29	31	31	29	28	29 16	30	30	31	31	31		29
	29	29	29							29	28	29 16							

STATION : Baroda (A) 42748 .. contd

	Weather						Wind speed				% Wind Direction									Total Cloud					Low cloud						Visibility				
MN	PPT	HAIL	THUN	FOG	D.STM	SQUA	62	61	19	0	N	NE	E	SE	S	SW	W	NW	0	0	T-2	3-5	6-7	8	0	T-2	3-5	6-7	8	F8	<1	1-4	4-10	10-20	>20
1	0.2	0.0	0.1	0.2	0.0	0.0	0	1	20	10	34	20	2	4	2	1	1	4	32	19	6	4	2	0	30	1	0	0	0	0	0.3	2.8	14.2	13.1	0.6
							0	2	27	2	26	14	2	0	1	4	11	34	8	19	6	4	2	0	28	2	1	0	0	0	0.0	0.1	2.3	18.9	9.7
2	0.2	0.0	0.1	0.2	0.0	0.0	0	1	18	9	25	18	4	8	5	4	2	5	29	19	4	3	2	0	26	1	1	0	0	0	0.1	2.1	12.1	13.1	0.6
							0	3	24	1	20	13	1	1	1	7	17	36	4	17	6	3	2	0	24	3	1	0	0	0	0.1	0.1	0.9	15.2	11.7
3	0.2	0.0	0.3	0.1	0.1	0.0	0	2	22	7	14	12	4	9	11	12	6	8	24	18	7	4	2	0	28	2	1	0	0	0	0.1	1.3	10.8	18.0	0.8
							0	4	26	1	11	5	2	1	1	11	24	41	4	16	8	5	2	0	26	4	1	0	0	0	0.0	0.1	0.9	17.0	13.0
4	0.1	0.0	0.5	0.0	0.1	0.0	0	2	24	4	12	5	1	2	10	25	14	20	11	19	6	4	1	0	27	2	1	0	0	0	0.0	0.4	9.8	18.9	0.9
							0	3	26	1	7	2	0	0	1	12	32	43	3	17	7	4	2	0	25	4	1	0	0	0	0.1	0.0	1.8	15.5	12.6
5	0.4	0.0	0.9	0.0	0.3	0.2	0	8	22	1	4	1	0	0	8	46	26	10	5	13	7	8	3	0	16	6	7	2	0	0	0.0	0.1	6.1	23.5	1.3
							0	10	20	1	2	1	0	0	4	38	33	19	3	17	9	3	2	0	23	7	1	0	0	0	0.0	0.1	1.7	17.4	11.8
6	7.1	0.0	4.1	0.0	0.2	0.2	0	10	20	0	1	1	0	2	15	51	25	3	2	1	3	10	11	5	4	6	15	5	0	0	0.0	0.7	9.0	19.3	1.0
							0	19	11	0	1	1	1	1	13	59	19	5	0	4	6	7	8	5	7	11	10	2	0	0	0.1	0.7	5.7	14.3	9.2
7	16.7	0.0	3.5	0.0	0.1	0.2	0	6	25	0	0	1	0	2	14	56	22	2	3	0	0	6	13	12	1	6	17	6	1	0	0.0	1.5	14.4	14.5	0.6
							0	16	15	0	0	0	0	2	17	59	17	2	3	0	0	6	14	11	1	7	17	5	1	0	0.1	1.0	8.3	16.1	5.5
8	17.0	0.0	2.7	0.0	0.0	0.0	0	3	27	1	1	0	0	1	9	55	27	4	3	0	1	3	12	15	2	6	16	6	1	0	0.0	1.4	14.2	14.8	0.6
							0	10	20	1	2	1	0	0	11	56	21	5	4	0	1	5	14	11	1	7	16	6	1	0	0.0	0.7	7.2	17.7	5.4
9	9.9	0.0	3.0	0.2	0.0	0.1	0	1	25	4	4	3	1	3	9	32	27	10	11	3	5	7	10	5	9	7	10	4	0	0	0.0	0.9	11.3	15.3	2.5
							0	4	24	2	5	6	1	1	6	28	31	14	8	1	7	9	9	4	3	13	11	3	0	0	0.0	0.3	3.3	13.3	13.1
10	1.7	0.0	1.6	0.3	0.0	0.0	0	1	23	7	11	15	8	14	11	6	5	6	24	13	8	5	4	1	23	4	3	1	0	0	0.1	0.7	8.5	18.3	3.4
							0	1	25	5	17	16	5	2	2	6	14	24	14	10	12	6	3	0	16	11	4	0	0	0	0.0	0.0	1.4	13.9	15.7
11	1.0	0.0	0.3	0.1	0.0	0.0	0	1	21	8	25	26	11	5	2	0	1	2	28	15	7	4	3	1	26	2	2	0	0	0	0.1	1.0	7.8	18.2	2.9
							0	0	25	5	21	19	11	1	1	2	4	26	15	15	7	4	3	1	23	5	2	0	0	0	0.0	0.1	0.9	15.8	13.2
12	0.3	0.0	0.2	0.1	0.0	0.0	0	1	22	8	33	27	5	4	1	0	0	3	27	16	7	5	2	1	29	1	1	0	0	0	0.1	1.2	11.9	15.9	1.9
							0	1	26	4	25	17	6	2	1	2	6	27	14	16	7	5	3	0	28	2	1	0	0	0	0.0	0.0	0.8	17.7	12.5
YR	54.8	0.0	17.3	1.2	0.8	0.7	0	37	269	59	14	11	3	5	8	24	13	6	16	136	61	63	65	40	221	44	74	24	2	0	0.8	14.1	130.1	202.9	17.1
LY							0	73	269	23	11	8	2	1	5	24	19	23	7	132	76	61	64	32	205	76	66	16	2	0	0.4	3.2	35.2	192.8	133.4
YRS				27					24				26									19					19					19		
									25				27									19					19					19		

Seismic Location

The project site lies in zone III as defined in IS: 1893 (Part 1)-2002. All the structures shall be designed complying with the requirements specified in IS: 1893 (Part-1) -2002 and (Part-4) - 2005.

Wind Pressure

Wind force on structures has been considered as per the provisions of IS: 875 (part-3)-1987. The basic wind speed of 39 m/sec at height of 10m above the ground level and wind assumed to blow in any direction and the most unfavorable condition shall be considered for design.

SECTION-C

SECTION-C1

SPECIFIC TECHNICAL REQUIREMENT

1.0 GENERAL

The specification covers design, engineering, manufacture, fabrication, assembly, inspection & testing at vendor's & sub-vendor's works, painting, forwarding, supply and delivery at site including start up and commissioning spares, mandatory spares, properly packed for transportation, unloading / handling and storage at site, in site transportation, assembly, erection and commissioning, trail run, preparation and submission of "As Built" drawings, site testing, carrying out performance guarantee tests at site and handover of **Condensate Polishing Unit and external regeneration system** as per the details in different sections / volumes of this specification for **1X800 MW WANAKBORI STPP.**

2.0 REFERENCE DOCUMENTS

A. PE-DG-408-155-A001 **:** P & ID FOR CONDENSATE POLISHING UNIT (SHEET 1 OF 2 AND SHEET 2 OF 2)

B. DATASHEET – A **:** FOR ABOVE SYSTEM

3.0 BRIEF DESCRIPTION OF THE SYSTEM

The proposed condensate polishing units shall treat the entire condensate of the turbine generator of each unit of power station. The proposed schematic arrangement of the condensate polishing unit and its regeneration facility shall be as per the enclosed P&I Diagram. Arrangement of piping, valves and instruments shown in the P&ID are bare minimum. The bidder shall include the complete system including regeneration facility as elaborated in this specification meeting the contractual requirements.

The condensate polishing service vessels shall be located in the TG hall of corresponding units. Condensate polisher unit (service vessels) will be provided on the discharge side of the high pressure condensate extraction pumps.

The resins shall be transferred to and from each regeneration facility by sluicing through a pipeline.

The regeneration process offered by the bidder shall be of proven design and shall essentially be the same process by virtue of which the bidder is qualified and shall give resin-separation compatible with the desired effluent quality.

4.0 SCOPE OF SUPPLY (MECHANICAL)

Broad scope of work of this package includes all equipment and accessories. Please also refer Mechanical data sheet, P&ID and the respective section of Electrical and C&I sections for respective scopes.

A. SERVICE VESSEL FACILITY

1) Three (3) nos. Condensate Polisher Mixed Beds (3x50%)(2Working+1Standby), each complete with condensate inlet and outlet connections, connections for resin transfer to and from the vessels, bed support-cum-under drain system, inlet water distributors, air distribution arrangement for resin mixing, all fittings and appurtenances etc. as specified and as required.

2) External resin traps at the outlet of each of the Condensate Polisher Mixed Beds each designed for in-place manual back wash facility.

3) Condensate inlet and outlet headers for each installation with pipe connections to each condensate polisher vessels. Resin transfer headers and pipe lines connecting the external regeneration facilities to the condensate polisher vessels of each installation.

4) Resin transfer lines of stainless steel construction between the External Regeneration Vessels and the Condensate Polisher Mixed Beds along with all necessary supports, anchors etc.

5) Rinse water outlet header from Condensate Polisher Mixed Beds to the Condenser hot well.

6) All necessary valves and fittings along with the actuators necessary for operation from CP System Control Panel. These shall include suitable arrangement to prevent accidental over pressurization of the resin transfer pipeline, DM water line, Blower line, service water line, instrument airline and regeneration facilities connected

to it which are designed for pressure much lower than that of the polisher service vessels. .

7) A common drain header for the Condensate Polisher Mixed Beds.

8) All necessary drains, vents and sampling points along with isolation valves as required.

9) Two (2) numbers (2x100%) (1Working+1Standby) capacity oil free type, air blowers along with the motor to supply necessary air for mixing the resins in the service vessels for each TG unit CPU. Each blower shall be complete with motor, V-belt drive with belt guard, inlet filter, silencer, flexible couplings and discharge snubber, acoustic hood, relief valve etc all mounted on a single base.

10) Two (2) numbers (2x100%) (1Working+1Standby) Rinse Recirculation Pumps, each complete with electrical drive motor and all other accessories as required.

11) All instrumentation and controls as required for operation of the CP System.

12) Gland sealing water piping for the valves in the rinse water line.

13) Emergency bypass system between the condensate inlet and outlet headers with its automatic valve, butterfly isolation valves (resilient material seated, to ensure bubble tight shut off) on both sides and controls for each on Condensate polisher mixed beds. The control valve can be of 2x50% or 1x100% configuration to achieve proper control under all operating conditions. Isolation valve shall be provided with geared operators for manual operation. The control system shall be so designed that the control valve is able to bypass 50% of rated flow when any of the service vessel is out of service and 100% of flow when all the service vessels are out of service.

14) Instrument racks for mounting pressure and flow transmitters, pressure switches, conductivity analyzers, etc. for each of Condensate Polisher Mixed Beds.

15) Five (5) numbers complete charges of resins. One charge will be defined as cation, anion & inert resin (if applicable) requirement for one service vessel.

16) One number Conductivity Analyser at condensate inlet header, condensate outlet header, outlet of each condensate polishing vessel.

17) One number common multichannel silica analyzer at outlet of the three service vessels for each unit.

18) Complete instrumentation and controls for this system, including the differential pressure transmitters, panel mounted indicating type controller with provision for remote manual operation, actuator for the control valve with positioner etc. All tubing, wiring, airsets, and other fittings, required to complete the system.

19) All the piping, valves, fitting, instruments, accessories etc. used in service vessel area shall be designed for an internal pressure of at least the design pressure of service vessels and for a maximum condensate flow of not less than total design flow of all the working service vessels. However all the piping, valves, fitting, instruments, accessories etc. used in service vessel area shall be 300# class (minimum) and this area shall be considered as high pressure side.

20) Minimum instrumentation required as per enclosed P & ID included in this tender specification.

21) Local Control Panel with Instruments, Push Buttons, Selector Switches, Annunciation Facility, etc. along with PLC for the control and safe operation of the CP System shall be provided. The PLC for CP System shall have all necessary interfaces for interlocking / control and signal exchange with the PLC for Regeneration.

22) All vessels as per P&ID & Data Sheet-A complete with inlet and outlet connections, bed support cum under drain system, inlets water distributors, all fittings and appurtenances etc. as specified and as required.

23) External resin/media traps at the outlet of each of the vessels, designed for in place manual backwashing.

24) Bidder to note that the equipment, valves, instruments indicated in the P&ID (PE-DG-408-155-A001 sheet 1 of 2 & sheet 2 of 2) attached in the technical specification are minimum and are in bidder's scope. During detailed engineering, bidder to furnish complete and detailed scheme in all respects including all valves, equipment's etc. for smooth, safe, efficient and trouble free operation of the plant meeting the specification requirement and also considering the applicable statutory requirement.

25) Necessary piping, fitting, valves, drains, vents, sampling etc. Pipe racks shall be provided by BHEL wherever

available, wherever pipe racks are not available, pipe shall be laid on pedestal to be provided by BHEL. However all auxiliary steel structure (U-clamps, nuts, bolts, channels etc) for fixing pipes on pedestal or racks shall be in bidder's scope.

26) All insert plates, rung ladder, nuts and bolts, and flanges and matching counter flanges wherever applicable.

27) All necessary valves and fittings for the installations with the actuators necessary for their remote operation.

28) Embedment plates with lugs shall also be provided by bidder as per system requirement.

29) All channels & brackets, mounting plates as required for mounting of motors, pumps, stirrers, tank etc shall be in bidder's scope.

30) Start-up and commissioning spares as required.

31) Mandatory spares as indicated in Annexure –II in the specification.

32) All special tools necessary for proper maintenance or adjustment of the equipment packed in permanent box. Operating platforms, permanent ladders (not rugs), supports and other structural works for each tanks, valves etc. to facilitate accessibility for operation and maintenance.

33) All necessary structural steel for pipe supporting structure, platforms, walkways / pathways and access stairs, mechanical plant and equipment, mechanical services and pipe work associated with Condensate polishing unit.

34) Finish paints for touch up painting of equipments after erection at site in sealed container.

35) All Motorized valves with integral starter as per requirement and as indicated in the P&ID (if applicable).

36) All pipes, fittings etc required for hand railing, platforms, and ladders shall be in the scope of bidder.

37) All handrails shall be of 32 mm nominal bore MS pipes (medium class) as per IS: 1161 galvanised using 750 gm/sq. m of zinc. Hand railing shall be a two-rail system with the top rail 1000 mm above the walkway surface and the intermediate rail 450 mm below the top rail. Handrail post spacing shall be limited to 1500 mm as far as possible but can be proportioned to the length of the opening. In such a case spacing shall not exceed 1850 mm centre to centre of posts. Hand railing shall be shop fabricated for specific locations and field welded or bolted to the erected structural steel. Railings shall be provided with 100 mm wide and 8 mm thick MS strip at bottom as toe guard all along the length of railing in horizontal plane. For RCC stairs, hand railing with 20 mm square MS bar balustrade with suitable MS flat and Aluminium / Teakwood handrail shall be provided, unless specifically mentioned otherwise.

38) Monitoring gadgets, instruments and equipments required for commissioning & maintenance (till PG test and plant handover).

39) Instrument hook up material shall be in bidder's scope.

40) Permanent ladder (not rungs) for approaching the top of tanks, valves for all steel inserts with lugs, plates, bolts, nuts, sleeves, edge angles and all other embedding components etc as required to grout in civil works and to support/hold the equipments being supplied under this specification for opening/maintenance purpose.

41) Wherever pipe racks are not available, pipes shall run on pedestals or below ground. All auxiliary structure & fixing items such as U clamps, nuts, bolts, channels, insert plates etc. required to lay the pipes on pedestals shall be in bidder's scope of work. Wrapping, coating and protection of all the buried pipe is also in bidder's scope.

42) Wrapping, coating and protection of the entire buried pipe shall be as per IS 10221 or AWWA C 203-93.

43) Any item/work either supply of equipment or erection material which have not been specifically mentioned in but are necessary to complete the woks for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification and shall be in bidder's scope without any commercial, technical and delivery implication to BHEL.

44) All other items are also included in scope of supply as specified in other part of the specification.

45) All required elbow, tee, pipe fittings etc. required for erection of the complete system including piping shall be

in bidder's scope. Bidder to provide the detailed BOQ during detail engineering

46) Bidder shall perform the guarantee parameters as per specification requirement to the satisfaction of owner. The exact modalities of verifying guarantee for the parameters indicated in the specification shall be finally as agreed with the owner during detailed engineering & mutually agreed.

47) Initial fill of resins, media and degasser tower packing for all vessels as required.

48) All the first fill and one Year's topping requirements of consumable such as greases, oil, lubricants, servo fluids/control fluids etc. which will be required to put the equipment covered under the scope of specifications, into successful commissioning / initial operation and to establish completion of facilities shall be in bidder's scope. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum.

49) All blank flanges/counter flanges, isolations valves, tees etc. to interconnect the pipes at all terminal points.

50) All necessary structural steel for pipe supporting structure, platforms, walkways / pathways and access stairs for mechanical plant and equipment, mechanical services and pipe work associated with Effluent Treatment Plant.

51) All steel inserts with lugs, plates, bolts, nuts, sleeves, edge angles and all other embedding components etc as required to grout in civil works and to support/hold the equipments being supplied under this specification for opening/maintenance purpose

B. EXTERNAL REGENERATION VESSELS

Regeneration area shall be considered as low pressure area. One (1) set of external regeneration system for regeneration of the ion exchange resins from all the turbo-generator units shall be provided. Each regeneration system shall consisting of at least the following:

1) One (1) number Resin Separation & Anion Resin Regeneration Vessel complete with internals, integral pipe works, valves, instruments, ladders, platforms, lifting lugs, manholes etc. and all other accessories as required.

2) One (1) number Cation Resin Regeneration Vessel complete with internals, integral pipe works, valves, instruments, ladders, platforms, lifting lugs, manholes etc. and all other accessories as required.

3) One (1) number Resin Isolation Vessel complete with internals, integral pipe works, valves, instruments, ladders, platforms, lifting lugs, manholes etc. and all other accessories as required.

4) One (1) number Mixed Resin Storage Vessel complete with internals, integral pipe works, valves, instruments, ladders, platforms, lifting lugs, manholes etc. and all other accessories as required.

(The type of vessels indicated against sr. no. 1), 2), 3) and 4) above is for reference only. The same shall depend on the supplier recommendations).

5) One (1) number Resin Injection Hopper, complete with a water ejector system for resin make-up complete with all accessories. Resin Make up hopper shall be sized to handle up to minimum 150 liters of as received new resins per single injection.

6) One (1) number Hose Station for Transfer of Hydrochloric Acid. The hose station shall have two (2) nos. each 80 mm NB rubber hose connections.

7) Two (2) numbers (2x100%) (1Working+1Standby) Hydrochloric Acid Transfer Pumps each complete with electrical drive motor and all other accessories as required.

8) One (1) number Hydrochloric Acid Storage Tank complete with internals, integral pipe works, valves, instruments, ladders, platforms, manhole, lifting lugs etc. and all other accessories as required.

9) One (1) number Hydrochloric Acid Measuring Tank for Polishers complete with internals, integral pipe works, valves, instruments, ladders, platforms, lifting lugs etc. and all other accessories as required.

10) Two (2) numbers (2x100%) (1Working+1Standby) Acid dosing pumps for dosing hydrochloric acid (30% conc.) along with electric motor drive, pulsation dampener & safety relief valve at the outlet header of each pump all other required accessories etc.

11) One (1) no. Hose Station for Transfer of Alkali. The hose station shall have two (2) nos. each 80 mm NB rubber hose connections.

12) Two (2) numbers (2x100%) (1Working+1Standby) Alkali Unloading Pumps, each complete with electrical drive motor and all other accessories as required.

13) Two (2) numbers (2x100%) (1Working+1Standby) Alkali Transfer Pumps, each complete with electrical drive motor and all other accessories as required.

14) One (1) number Activated Carbon Filter for Alkali, complete with internals, integral pipe works, valves, instruments, ladders, platforms, lifting lugs, manhole, carbon trap etc. and all other accessories as required.

15) One (1) number Alkali Storage Tank complete with internals, integral pipe works, valves, instruments, ladders, platforms, lifting lugs manhole, etc. and all other accessories as required.

16) One (1) number Alkali Measuring Tank for Polishers, complete with internals, integral pipe works, valves, instruments, ladders, platforms, lifting lugs, dissolving basket, agitator etc. and all other accessories as required.

17) Two (2) numbers (2x100%) (1Working+1Standby) Alkali dosing pumps, for dosing NaOH (48% conc.) along with electric motor drive, pulsation dampener & safety relief valve at the outlet header of each pump all other required accessories etc.

18) Two (2) numbers (2X100%) (1Working+1Standby) oil free type air blowers with electric motor drives, for supplying all the process air required for cleaning of the resins and their regeneration processes. Each blower shall be complete with motor, V-belt drive with belt guard, inlet filter, silencer, flexible couplings and discharge snubber, acoustic hood, relief valve etc all mounted on a single base.

19) One (1) number Dematerialized Water Storage Tank complete with all accessories.

20) Two (2) numbers (2X100%) (1Working+1Standby) DM Water Regeneration / Resin Transfer Pumps each with electric drive motor, one normally operating and the other standby, for water supply for chemical preparation / dosing and transfer of resin from Condensate Polisher Mixed Beds to Regeneration vessels and vice-versa, backwash etc.

21) One (1) number hot water tank complete with heaters (2X50%), internals, integral pipe works, valves, instruments, ladders, platforms, lifting lugs etc. and all other accessories as required. Hot water tank shall be adequately insulated to restrict the outside temperature to 60 deg. C with 25 mm thick (mm) mineral wool insulation on all external surfaces, covered with 16 gauge galvanized iron sheet jacketing.

22) Diluent DM Water Supply System, separately for acid and alkali, each provided with an automatic on-off valve, a throttling valve for setting of flow, a local flow indicator and a mixing tee where the chemicals get injected into the water stream.

23) Common Waste Effluent Header with one resin trap designed for in-place manual backwash.

24) One (1) number Acid Measuring Tank for neutralization, complete with internals, integral pipe works, valves, instruments, ladders, platforms, lifting lugs etc. and all other accessories as required.

25) One (1) number Alkali Measuring Tank for neutralization, complete with internals, integral pipe works, valves, instruments, ladders, platforms, lifting lugs, dissolving basket, agitator etc. and all other accessories as required.

26) Two (2) numbers (2X100%) (1Working+1Standby) Neutralized Waste Transfer Pumps, each complete with electrical drive motor and all other accessories as required.

27) DM water piping for dilution, resin transfer, backwashing, flushing, rinsing etc. including the DM water piping along with all supports and hangers between the Regeneration Facility and the CP System.

28) All necessary valves and fittings along with the actuators necessary for their remote automatic operation. These shall include all drains, vents, sampling points with isolation valves as required.

29) All other integral and interconnected pipe works, valves, sump, gates, all types of pipe supports, pipe etc. for the entire Plant.

30) All internals, fittings and appurtenances for these vessels.

31) Operating platforms, ladders, supports and other structural works as required to facilitate accessibility for operation and maintenance for all the Condensate Polisher Mixed Beds, Regeneration Vessels, Storage Tanks and other equipment.

32) Programmable Logic Controller and CRT/Keyboard based operator console & engineering console for the interlock, control and safe operation of regeneration of CP System.

33) All drive motors / actuators associated with the system / equipment.

34) First fill of resins for all Condensate Polisher Mixed Beds, mixed storage vessel and makeup resin hopper and also first fill of lubricants and grease.

35) All instruments, process switches, analysers, control valves, solenoid valves, etc. as required.

36) All junction and solenoid Boxes.

37) All cable glands and lugs as required shall be provided by the Bidder.

38) Pneumatic & Process hook up tubing / piping.

39) All anchor bolts, foundation plates sleeves, nuts, inserts, etc. to be embedded in concrete for entire CP System.

40) Safety equipments as indicated elsewhere in the specification.

52) Bidder to note that the equipment, valves, instruments indicated in the P&ID (PE-DG-408-155-A001 sheet 1 of 2 & sheet 2 of 2) attached in the technical specification are minimum and are in bidder's scope. During detailed engineering, bidder to furnish complete and detailed scheme in all respects including all valves, equipment's etc. for smooth, safe, efficient and trouble free operation of the plant meeting the specification requirement and also considering the applicable statutory requirement.

53) Necessary piping, fitting, valves, drains, vents, sampling etc. Pipe racks shall be provided by BHEL wherever available, wherever pipe racks are not available, pipe shall be laid on pedestal to be provided by BHEL. However all auxiliary steel structure (U-clamps, nuts, bolts, channels etc) for fixing pipes on pedestal or racks shall be in bidder's scope.

54) All insert plates, rung ladder, nuts and bolts, and flanges and matching counter flanges wherever applicable.

55) All necessary valves and fittings for the installations with the actuators necessary for their remote operation.

56) Embedment plates with lugs shall also be provided by bidder as per system requirement.

57) All channels & brackets, mounting plates as required for mounting of motors, pumps, stirrers, tank etc shall be in bidder's scope.

58) Start-up and commissioning spares as required.

59) Mandatory spares as indicated in Annexure –II in the specification.

60) All special tools necessary for proper maintenance or adjustment of the equipment packed in permanent box. Operating platforms, permanent ladders (not rugs), supports and other structural works for each tanks, valves

etc. to facilitate accessibility for operation and maintenance.

61) All necessary structural steel for pipe supporting structure, platforms, walkways / pathways and access stairs, mechanical plant and equipment, mechanical services and pipe work associated with Condensate polishing unit.

62) Finish paints for touch up painting of equipments after erection at site in sealed container.

63) All Motorized valves with integral starter as per requirement and as indicated in the P&ID (if applicable).

64) All pipes, fittings etc required for hand railing, platforms, and ladders shall be in the scope of bidder.

65) All handrails shall be of 32 mm nominal bore MS pipes (medium class) as per IS: 1161 galvanised using 750 gm/sq. m of zinc. Hand railing shall be a two-rail system with the top rail 1000 mm above the walkway surface and the intermediate rail 450 mm below the top rail. Handrail post spacing shall be limited to 1500 mm as far as possible but can be proportioned to the length of the opening. In such a case spacing shall not exceed 1850 mm centre to centre of posts. Hand railing shall be shop fabricated for specific locations and field welded or bolted to the erected structural steel. Railings shall be provided with 100 mm wide and 8 mm thick MS strip at bottom as toe guard all along the length of railing in horizontal plane. For RCC stairs, hand railing with 20 mm square MS bar balustrade with suitable MS flat and Aluminium / Teakwood handrail shall be provided, unless specifically mentioned otherwise.

66) Monitoring gadgets, instruments and equipments required for commissioning & maintenance (till PG test and plant handover).

67) Instrument hook up material shall be in bidder’s scope.

68) Permanent ladder (not rungs) for approaching the top of tanks, valves for all steel inserts with lugs, plates, bolts, nuts, sleeves, edge angles and all other embedding components etc as required to grout in civil works and to support/hold the equipments being supplied under this specification for opening/maintenance purpose.

69) Wherever pipe racks are not available, pipes shall run on pedestals or below ground. All auxiliary structure & fixing items such as U clamps, nuts, bolts, channels, insert plates etc. required to lay the pipes on pedestals shall be in bidder’s scope of work. Wrapping, coating and protection of all the buried pipe is also in bidder’s scope.

70) Wrapping, coating and protection of the entire buried pipe shall be as per IS 10221 or AWWA C 203-93.

71) Any item/work either supply of equipment or erection material which have not been specifically mentioned in but are necessary to complete the woks for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification and shall be in bidder’s scope without any commercial, technical and delivery implication to BHEL.

72) All other items are also included in scope of supply as specified in other part of the specification.

73) All required elbow, tee, pipe fittings etc. required for erection of the complete system including piping shall be in bidder’s scope. Bidder to provide the detailed BOQ during detail engineering

74) Bidder shall perform the guarantee parameters as per specification requirement to the satisfaction of owner. The exact modalities of verifying guarantee for the parameters indicated in the specification shall be finally as agreed with the owner during detailed engineering & mutually agreed.

75) Initial fill of resins, media and degasser tower packing for all vessels as required.

76) All the first fill and one Year's topping requirements of consumable such as greases, oil, lubricants, servo fluids/control fluids etc. which will be required to put the equipment covered under the scope of specifications, into successful commissioning / initial operation and to establish completion of facilities shall be in bidder’s scope. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum.

77) All blank flanges/counter flanges, isolations valves, tees etc. to interconnect the pipes at all terminal points.

78) All necessary structural steel for pipe supporting structure, platforms, walkways / pathways and access stairs for mechanical plant and equipment, mechanical services and pipe work associated with Effluent Treatment

Plant.

79) All steel inserts with lugs, plates, bolts, nuts, sleeves, edge angles and all other embedding components etc as required to grout in civil works and to support/hold the equipments being supplied under this specification for opening/maintenance purpose.

C. PIPING

All the piping as listed below & indicated in P&ID for Condensate Polishing Unit shall be in bidder's scope. The below indicated pipes shall be designed, supplied, erected, laid and tested by the bidder. Elbows, tees, flanges Hangers and supports, embedment plates with lugs etc required for the below given piping shall also be provided by the bidder.

1) Minimum OD 457.0 X 12.7 mm thick service vessel inlet header confirming to CS ASTM A 106 Gr-B.

2) Minimum OD 457.0 X 12.7 mm thick service vessel outlet header confirming to CS to ASTM A 106 Gr-B.

3) Rinse water outlet piping to Condenser hot well shall be SA 106 Gr-B (minimum OD 168.3 x 7.11 mm). The distance between CPU service vessels to condenser hotwell shall be considered as 100 meters and this piping shall also be in bidder's scope.

4) Rinse recirculation piping confirming to CS to ASTM A 106 Gr-B.

5) Resin transfer piping shall be minimum 80 NB and of Stainless Steel material to ASTM A 312 TP 304. 10 S seamless (minimum). One way piping distance for resin Transfer Piping between farthest service vessel and regeneration area shall be 600 meters. Complete resin transfer piping shall be in bidder's scope. Other details have been attached elsewhere in the tender technical specification.

6) Piping handling DM water shall be CSRL (Carbon steel rubber lined) for sizes 40 mm NB and above. The Carbon steel piping shall conform to IS 1239 Part I (heavy)/IS 3589 or equivalent. One way piping distance for DM water piping between farthest service vessel and regeneration area shall be 600 meters. Complete DM water piping shall be in bidder's scope. Other details have been attached elsewhere in the tender technical specification.

7) The regeneration waste of Condensate polishing unit shall be led to the neutralization pit of Condensate polishing unit regeneration area. For further disposal of effluents from CPU Regeneration area N pit up to the central monitoring basin bidder to provide two nos (2X100%) Effluent disposal pumps, along with recirculation line of the pumps. The piping distance between CPU Regeneration area N pit and central monitoring basin shall be 750 meters. The material of the piping shall be Rubber lined ERW carbon steel pipe to ASTM A53 Gr. B/IS-1239, Part-I, Heavy grade. For small diameter pipe (<=40NB), where rubber lining is difficult stainless steel pipe to ASTM A 312 TP 304 Sch. 40S instead of rubber lined steel pipe shall be used.

8) Piping handling acid/alkali shall be of Rubber lined ERW carbon steel pipe to ASTM A53 Gr. B/IS-1239, Part-I, Heavy grade. For small diameter pipe (<=40NB), where rubber lining is difficult, CPVC PN 10 shall be used for hydrochloric acid and stainless steel pipe to ASTM A 312 TP 304 Sch. 40S instead of rubber lined steel pipe shall be used for alkali services.

9) Piping for instrument air service (sizes less than and equal to 50 mm NB) shall be shall be Galvanised Steel Pipe to ASTM 53 Gr. B/IS: 1239, Part-I, heavy grade.

10) Service water piping in CPU service vessel area (used for cooling of condensate sample), Service water piping in each CPU regeneration area, instrument air piping for each CPU service vessel area & each regeneration area and service air piping for each CPU service vessel area & each regeneration area, potable water piping for each CPU regeneration area etc. shall also be in bidder's scope.

11) All piping between external regeneration facility and the skids for chemical dosing and acid/alkali preparation shall also be designed, supplied, erected and tested by the bidder. These shall include demineralized water piping to the chemical dosing, acid /alkali piping from external bulk storage tanks to respective preparation skids, the alkali preparation skids from the external regeneration facility, alkali solution from its preparation facility to the alkali dosing skid, dilute chemical solution piping for acid and alkali from the dosing skids to the external regeneration facility, piping to the preparation/dosing facilities, instrument air piping and power supply for immersion heaters of the diluent water tank from the regeneration facility, and all instrumentation and control wiring between these skids, etc.

12) All piping within all the skids/equipment shall also be in bidder's scope.

5.0 SCOPE OF SUPPLY (ELECTRICAL)

Complete electrical as per specification and details indicated in Section C2 (Specific Technical Requirement Electrical).

6.0 SCOPE OF SUPPLY (C&I)

Complete C&I as per specification and details indicated in Section C3 (Specific Technical Requirement C&I).

7.0 SCOPE OF SUPPLY (CIVIL)

Total Civil is in BHEL's Scope of work, however complete grouting for equipment, fixing and any concreting inside the vessels and lining shall be in bidder's scope.

Also detailed Civil Input drawing shall be provided by bidder. Successful bidder shall furnish civil assignment drawings. The corresponding CIVIL drawing prepared by BHEL / CIVIL agency, based on civil assignment drawing of bidder will be furnished to the successful bidder for concurrence

8.0 SCOPE OF SERVICES

The bidder's scope also includes following services for scope under this specification:

1) Erection and Commissioning, unloading, storage and handling at site.

2) Arrangement of all instruments, reagents, monitoring gadgets for monitoring, pre-commissioning, carrying out trial run & commissioning and Performance guarantee test.

3) Monitoring gadgets, instruments and equipments required for maintenance.

4) Complete grouting for equipment, fixing and any concreting inside the vessels and lining.

5) All personnel required during maintenance, Commissioning and Performance guarantee test.

6) Trial run for requisite period.

7) Performance guarantee test.

8) Painting shall be as specified in "Painting & Color scheme" Annexure –III of this technical specification. However any variation in the painting schedule as finally approved by BHEL & Customer shall be taken care by the bidder without any commercial & delivery implication to BHEL & Customer. Bidder to note that paint shed shall be finalized during detailed engineering as per customer & BHEL requirement and any variation in the painting schedule as finally approved by customer shall be taken care by bidder without any commercial and delivery implication.

9) Bidder shall also provide one final coat additionally of same DFT as specified in tender specification at site after completion of erection of each equipment / item.

9.0 TERMINAL POINTS

9.1 **CONDENSATE POLISHING PLANT - SERVICE VESSEL AREA**

(i) Service vessel inlet – (OD 457.2 X 12.7 mm thick, CS to ASTM A 106 Gr-C Seamless) - Single piping connection near service vessel area, as per attached Composite Piping Layout Plan below Mezzanine Floor Rev 00 (BHEL Drg. No. PE-DG-408-100-M032) attached elsewhere in the technical specification. Further piping is in bidder's scope.

(ii) Service vessel outlet – (OD 457.2 X 12.7 mm thick, CS to ASTM A 106 Gr-C Seamless) - Single piping connection near service vessel area, as per attached Composite Piping Layout Plan below Mezzanine Floor

Rev 00 (BHEL Drg. No. PE-DG-408-100-M032) attached elsewhere in the technical specification. Further piping is in bidder's scope.

(iii) Rinse water outlet- Rinse water outlet piping (OD 168.3 x 7.11 mm, CS to ASTM A 106 Gr-B Seamless) till Condenser Hotwell is in the scope of bidder. The piping distance to be considered is 100 meters.

(iv) 25 NB connection of Instrument air supply at 5 to 7 kg/cm2 (g) – At 5 meter distance from service vessel area at 0.5 meters above FGL at end closer to pipe rack/ pedestal. However distribution and piping inside service vessel area shall be in bidder's scope.

(v) Service air – To suffice the requirement of service air, bidder to provide necessary compressors, valves, pipings, fittings, flanges, instruments etc.

(vi) Gland sealing water supply & analyser rack cooling water supply piping - Service water connection (50 NB) at 5 meter distance from service vessel area at 0.5 meters above FGL at end closer to pipe rack/ pedestal. However distribution and piping inside service vessel area shall be in bidder's scope.

9.2 **EXTERNAL REGENERATION AREA**

(i) DM Water Supply – At 5 meter distance from CPU regeneration area at 0.5 meters above FGL at end closer to pipe rack/ pedestal. Further distribution of DM water piping inside CPU regeneration area is in bidder's scope. The line size shall be Ø114.3X3.05 (Stainless steel ASTM A312 TP 304 (ERW)). The other details of this terminal point shall be as per P&ID of Condensate transfer system Rev 03 (BHEL DRG. NO. PE-DG-408-100-N109) attached elsewhere in the technical specification.

(ii) 25 NB connection of Instrument air supply at 5 to 7 kg/cm2 (g) – At 5 meter distance from CPU regeneration area at 0.5 meters above FGL at end closer to pipe rack/ pedestal. However distribution and piping inside CPU regeneration area shall be in bidder's scope.

(iii) Service air – To suffice the requirement of service air bidder to provide necessary compressors, valves, pipings, fittings, flanges, instruments etc.

(iv) Service water (50 NB) - At 5 meter distance from CPU regeneration area at 0.5 meters above FGL at end closer to pipe rack/ pedestal. However distribution and piping inside CPU regeneration area shall be in bidder's scope.

(v) Drinking water (or potable water) of 25 NB connections - At 5 meter distance from CPU regeneration area at 0.5 meters above FGL at end closer to pipe rack/ pedestal. However distribution and piping inside CPU regeneration area shall be in bidder's scope.

10.0 EXCLUSIONS

1) All civil works including foundation of equipment. However complete grouting for equipment, fixing and any concreting inside vessels and lining shall be in the scope of the bidder. Also civil works including operating / maintenance platforms and interconnection platforms (if any) with ladders / stairs & handrails, structural supports and hangers for pipes / cables / ducts, crane rails, all embedment's and inserts with lugs including anchor fasteners, bolts etc., dressing of foundations, grouting of pockets and underpinning of base plates for equipment / structures and fixing supports, filling and finishing of openings in walls, floors, cladding, roof and trenches shall be in bidder's scope.

2) Instrument air & service air up to terminal points.

3) All chemicals.

4) Air conditioning, ventilation & fire fighting facilities.

5) Other exclusions are mentioned in the electrical & C&I parts of this specification.

6) Drinking water (or potable water), service water up to terminal points.

7) Regeneration effluents and other drains from equipments, vessels, tank etc shall be drained to N-pit

through drain trenches. The required piping, valves fittings, instruments etc shall be in bidder's scope.

11.0 QP AND SUB VENDOR APPROVAL

1) The quality assurance plan is enclosed elsewhere in technical specification**.** However requirement of detailed QP, inspection checklist, certificate of conformance etc. for each equipment and sub-vendor shall be finalized during detailed engineering stage; decision of BHEL/customer shall be binding on vendor in this regard. Any changes/additional tests insisted upon by Owner during approval of QAP's shall be accepted by bidder without any commercial and delivery implication to BHEL/Customer. Bidder shall submit the quality plans in BHEL format during detailed engineering stage. Bidder to note further that during detailed engineering all the QAP's/check lists etc. shall be submitted to Customer/BHEL for approval. All inspection & testing etc. shall be carried out accordingly.

2) The approved sub vendor list is enclosed as Annexure -I in technical specification. Any additional sub vendor is subject to approval / acceptance by BHEL/customer during detailed engineering stage. Bidder to propose additional sub vendor list with back up documents (experience list, end user certificate as applicable) etc. The same shall subject to BHEL and Customer approval during detailed engineering stage without any technical, commercial & delivery implication to BHEL.

12.0 PERFORMANCE GUARANTEE TEST

The Performance guarantee test shall be as per Section-C2-C.

13.0 DESIGN/ CONSTRUCTION

In addition to the requirements of Section C & D the following shall also be complied under scope of this specification.

The P&IDs (**Dwg.No.- PE-DG-408-155-A001 sheet 1of 2 and sheet 2 of 2**) is enclosed herein in this section for bidders compliance.

The material of construction specified in data sheet-A are minimum requirements and material of construction for other components not specified shall be similarly selected by the bidder for intended duty which shall be subject to BHEL / Customer approval during detail engineering without any commercial & delivery implication to BHEL.

14.0 DRAWING/DOCUMENTS REQUIREMENT

For the Drawings/Documents submission schedule, please refer ANNEXURE-VIII.

For the Drawings/Documents Submission Procedure, please refer ANNEXURE-VI Covered under section C2-B (General Technical Requirements – Engineering Services). The bidder has to submit the revised drawing/document along with the compliance sheet indicating enumerate reply to all BHEL and customer comments or observations. Without compliance sheet the submission of the drawings/documents will not be considered and the delay on this account will be solely on bidder's side only. Bidder to comply with the observations of the BHEL and CUSTOMER without price & delivery implication.

15.0 SPARES

1. All the spares for the equipment under the contract provided by the vendor will strictly conform to the specifications and documents and will be identical to the corresponding main equipment/components supplied under the contract.
2. The quality plan and the inspection requirement finalized for the main equipment will also be applicable to the corresponding spares.
3. The list of mandatory spares considered essential by the BHEL & Customer is indicated in Annexure II. The bidder shall indicate the prices in the 'Schedule of mandatory Spares' whether or not he considers it necessary for the BHEL & Customer to have such spares. If the bidder fails to comply with the above or fails to quote the price of any spare item, the cost of such spares shall be deemed to be included in the contract price. The bidder shall furnish the population per unit of each item. Whenever the quantity is mentioned in "sets" the bidder has to give the item details and prices of each item.

All mandatory spares shall be delivered at site at least two months before scheduled date of initial operation of the first unit. However, spares shall not be dispatched before dispatch of corresponding main equipments.

Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise.

4. Start-up and commissioning spares are in bidder's scope of supply.

Start-up and Commissioning spares are those which would be required during equipment or system testing, start-up and commissioning. All spares used until the plant is finally handed over by the bidder to the customer come under this category. All start-up and commissioning spares as required shall be provided by the bidder without any additional cost to the BHEL and customer. List of spares shall be furnished by BIDDER along with the offer.

Bidder shall be responsible for the ready and timely availability for all the startup and commissioning spares as required during various stages of testing, cleaning and commissioning up to handing over of each unit of the total plant.

An adequate stock of start-up spares shall be available at the site such that the start-up and commissioning of the equipment/systems, Performance guarantee test and handing over the equipment/ systems to the customer will be carried out without hindrance and delay. All start-up spares which remain unused after the taking over of the plant shall remain the property of the customer.

5. In addition to the spare parts mentioned above, the Bidder shall also provide a list of recommended spares giving unit prices and total prices for 2 years of normal operation of the plant for spares of indigenous origin, and for 5 years of normal operation for spares of non-indigenous origin. This list shall take into consideration the mandatory spares specified elsewhere in the specification and should be a separate list.

BHEL reserves the right to buy any or all of the recommended spares. The price of recommended spares will not be used for the evaluation of bids. The price of these spares shall remain valid for a period as specified elsewhere in the specification from the date of Award of the Contract. Where the recommended spares are the same as mandatory spares, the prices shall be the same. The prices of any recommended spares, which are not common with mandatory spares, shall be subject to review by the BHEL/Customer, and shall be finalised after mutual discussion.

6. **The vendor warrants:**

(i) That all spares supplied will be new and in accordance with the contract document and will be free from defects in design, material and workmanship and shall further guarantee as under:

(ii) In case of any failure in the original component/equipments due to faulty designs, materials and workmanship, the corresponding spare parts if any, supplied will be replaced without any extra cost to the BHEL and customer unless a joint examination and analysis by BHEL and/or customer of such spare parts prove that the defect found in the original part that failed can safely be assured not to be present in spare parts.

(iii) The long term availability of spares to the BHEL and the customer for the full life of the equipment covered under the contract and that before going out of production of spare parts of the equipment covered under the contract, vendor and his sub-vendors shall give the BHEL and the customer at least 24 (Twenty Four) months advance notice so that the latter may order his bulk requirements of spares, if he so desires. The same provision will also be applicable to the sub-vendors. Further, in case of discontinuance of manufacture of any spares by the vendors or his sub-vendors the vendors and his sub-vendors, will provide the BHEL and the customer, 2 (two) years in advance, with full manufacturing drawings, material specifications and technical information required by the BHEL and the customer for the purpose of manufacture of such items and also the right to manufacture such spares for their own requirements.

(iv) Further in case of discontinuance of supply of spares by the vendors or his sub-vendors, the vendor will provide the BHEL and the customer with full information for replacement of such spares with other equivalent makes, if so required by the BHEL and the customer.

(v) Notwithstanding the above, the vendor shall be responsible for supply of spares for the lifetime of the package at reasonable prices. The prices of all future requirements of spares shall be derived from the corresponding ex-works price at which the orders for such spares have been placed by the BHEL and the customer as a part

of the mandatory or long term or any other kind of spares. The base indices for calculating ex-works price shall be commissioning of last equipment under main contract.

7. The vendor will indicate the delivery period of the spares, which the BHEL and the customer may procure in accordance with this clause.

8. In case of emergency requirements of spares, the vendor would make every effort to expedite the manufacture and delivery of such spares on the basis of mutually agreed time schedule.

9. In case the vendor fails to supply the mandatory or long term or any other kind of spares on the terms stipulated above, the BHEL and the customer shall be entitled to purchase the same from the alternate sources at the risk and the cost of the vendor and recover from the vendor, the excess amount paid by the BHEL and the customer over the rates as per the contract. In the event of such risk purchase by the BHEL or the customer, the purchases will be as per the works and procurement policy of the BHEL and the customer prevalent at the time of such purchases and BHEL & the customer at his option may include a representative from the vendor in finalizing the purchases.

10. It is expressly understood that the final settlement between the parties in terms of relevant clauses of the tender document shall not relieve the vendor of any of his obligations under the provision of long term availability of spares and such provisions shall continue to be enforced till the expiry of 30 (thirty) years period reckoned from the scheduled date of completion of trial operation of the last equipment unless otherwise discharged expressly in writing by the BHEL or the customer.

16.0 MINIMUM IMPORTED ITEMS

- Resins.

17.0 ADDITIONAL REQUIREMENT

17.1 Wherever pipe racks are not available, pipes shall run on pedestals or below ground. All fixing items such as U clamps, nuts, bolts etc. required to lay the pipes on pedestals shall be in bidder's scope of work. Coating, wrapping and protection required for buries pipes shall be in bidder's scope of work.

17.2 Wherever pipes are running on pipe rack, Bidder will consider 12 m static head + 10% margin ,in addition to the losses in straight length and bend in pipes and valves etc. while selection of pump head during detailed engineering.

17.3 All the first fill and one Year's topping requirements or 10 % of first fill quantity, whichever is more of consumable such as greases, oil, lubricants, servo fluids/control fluids, gases and etc. which will be required to put the equipment covered under the scope of specifications, into successful commissioning / initial operation and to establish completion of facilities shall be furnished by the bidder. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum.

17.4 Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.

17.5 In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.

17.6 Bidders shall make Site visit in order to familiarize themselves with existing condition of site before submitting the bid in order to make their offer complete. During detail engineering also, the successful bidder shall be responsible for the correctness of details w.r.t. existing facility at site. Customer approval on any drawing having details of existing facility shall not be cited by the successful bidder a valid reason for any shortcoming in the work by them. BHEL shall also not entertain any cost implication for any lack of input data with regard to site during detail engineering.

17.7 Final Electrical Load list will be submitted by the successful bidder as per agreed drawing/ doc submission schedule. Thereafter any change in the electrical load list shall be entertained only subject to its feasibility, and BHEL reserves the right to debit the vendor cost of any changes necessitated in the switch gear /MCC on account of changed loads.

17.8 Wherever CIVIL works is excluded from the bidder's scope, successful bidder shall furnish civil assignment / scope drawings. The corresponding CIVIL drawing prepared by BHEL / CIVIL agency, based on civil assignment drawing of bidder will be furnished to the successful bidder for concurrence. In case any modification is required in the civil work already carried out based on final civil inputs given by vendor, BHEL reserves the right to debit cost of such rework to vendor".

17.9 The complete system shall be proven and necessary design documentation in support of proveness shall be submitted by the successful bidder in support of the systems, if asked by the customer without any price and delivery implication to BHEL and customer.

17.10 System to be designed to meet all the statutory requirements. Preparation of all necessary drawings/data/ documents for obtaining necessary Approval of statutory authorities like CCE , IBR , Weight & Measures Department and any other agency/ competent authority ,on behalf of the customer, related to installation of DM plant (if required) is included in bidder's scope. All expenses required to obtain the approval shall also be borne by the successful bidder. Successful bidder shall inform customer well in advance requirement of authority letter along with format for the same. After issuance of authority letter by customer, it will be vendor's responsibility to regularly follow up with the concerned authorities to obtain timely approval from these authorities. Any delay on account of the same, unless any specific information related to above approval to be furnished by customer is delayed by customer, shall be to vendor's account and shall not be used as a reason for extension in contract completion.

17.11 Vendor to attend regular engineering meeting with BHEL and customer fortnightly in BHEL or customer office as decided during detail engineering. Vendor will depute all his concerned engineering representative along with the project manager for discussion and approval. Meeting can be held at site also.

17.12 All regeneration vessels and chemical dosing facilities shall be located in Building. Bulk chemical storage tanks, unloading and transfer pumps shall be located open to sky. However control panels shall be located in building in regeneration area.

17.13 Space available for CPU service Vessels area & CPU Regeneration area (Vide ref. Dwg. No. PE-DG-408-155-A002 & PE-DG-408-155-A003) are attached elsewhere in the technical specification. Bidder to accommodate their equipment within the space provided.

17.14 Bidder to submit BBU during detailed engineering after approval of Basic documents. BBU shall be equal to BOQ for the package and there shall be no price and delivery implication is applicable to BHEL / CUSTOMER for the same. None of the items supplied for the project as non-billable. Incomplete BBU shall not be review by BHEL.

17.15 Preparation of drawings / document / P&ID's in 3D modelling software and providing soft copy of same to BHEL.

17.16 Training of plant Owner's personnel, O&M operators' personnel on plant operation and maintenance.

17.17 Relevant requirements as per GTR, GCC, ECC & SCC.

17.18 Any statutory requirement / clearance required for the packages from government / local body shall be in bidder's scope.

17.19 Design pressure of all the pressure vessels should be the maximum expected pressure to which the vessel may be subjected plus 5% extra margin. Maximum expected pressure for a vessel placed in the discharge line of a pump shall be based on the shut-off head of the pump plus static head at pump suction, if any.

17.20 In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.

17.21 Operating platforms, ladders, supports and other structural works for each vessel and tanks to facilitate accessibility for operation and maintenance for all the condensate polisher mixed beds, regeneration vessels, storage tanks, alkali and acid measuring tanks & preparation tanks and other equipment's etc. is also in bidder's scope.

17.22 Successful bidder shall furnish detailed erection manual for each of the equipment as well as complete system supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.

17.23 Necessary approach (platform) shall be provided for all the Pneumatic Valves & Flow Orifice Plates. Necessary drawing/documents, indicating the same, shall be provided by successful bidder during contract stage.

17.24 Latest version of all codes and standards to be followed.

17.25 SITE VISIT BEFORE SUBMISSION OF OFFER.

Bidders shall make Site visit in order to familiarize themselves with existing condition of site before submitting the bid in order to make their offer complete. During detail engineering also, the successful bidder shall be responsible for the correctness of details w.r.t existing facility at site. Customer approval on any drawing having details of existing facility shall not be cited by the successful bidder a valid reason for any shortcoming in the work by them. BHEL shall also not entertain any cost implication for any lack of input data with regard to site during detail engineering.

SYSTEM DESCRIPTION AND DESIGN PHILOSOPHY OF CONDENSATE POLISHING UNIT

1.0 INTRODUCTION:

The purpose of the system is to reduce the total dissolved solids in Condensate of 1 x 800 MW, WANAKBORI TPS under the scope of BHEL.

2.0 SYSTEM DESCRIPTION OF CONDENSATE POLISHING UNIT (Ref. Drg. no. PE-DG-408-155- A001):

The proposed condensate polishing units shall treat the entire condensate of the turbine generator of each unit of power station. The proposed schematic arrangement of the condensate polishing unit and its regeneration facility shall be as per the enclosed P&I Diagram. Arrangement of piping, valves and instruments shown in the P&ID are bare minimum. The bidder shall include the complete system including regeneration facility as elaborated in this specification meeting the contractual requirements.

The condensate polishing service vessels shall be located in the TG hall of corresponding units. Condensate polisher unit (service vessels) will be provided on the discharge side of the high pressure condensate extraction pumps.

There shall be three service vessels (3X50%) for 800 MW unit each polishing 50% of the condensate flow corresponding to VWO (valve wide open) condition at 1% make up (Flow through each service vessel indicated in the data sheet).

A common external regeneration facility for both the units shall be provided. For regeneration, resin from the exhausted Condensate Polisher Mixed Bed will be transferred hydraulically/hydro pneumatically.

The resins shall be transferred to and from each regeneration facility by sluicing through a pipeline.

The regeneration process offered by the bidder shall be of proven design and shall essentially be the same process by virtue of which the bidder is qualified and shall give resin-separation compatible with the desired effluent quality.

I. SALIENT DESIGN DATA

(a) NORMAL RUN

The following dissolved solids concentration and conditions shall be used as a basis of design for the condensate polishing system.
The ionic concentrations indicated below are as such.

DESIGN ANALYSIS OF CRUDE CONDENSATE DURING NORMAL RUN

CONTAMINANTS	UNIT	INFLUENT
Ammonia	Ppb	500
Total Dissolved Solids (TDS, ammonia and Silica excluded)	Ppb	125 approx
Copper	Ppb	5
Total Ferric Iron	Ppb	50
pH value (polisher runs at 25^0C with H / OH mode)	Ppb	8.8-9.5
Chloride (as Cl)	Ppb	10
Sodium (as Na)	Ppb	10
Silica (as SiO2)	Ppb	30
Crud (mostly black oxide of iron)	Ppb	100
Conductivity (at 25^0C)	µS/cm	0.5

ANALYSIS OF TREATED CONDENSATE DURING NORMAL RUN

CONTAMINANTS	UNIT	EFFLUENT
Total Dissolved Solids	Ppb	< 20
Silica (as SiO2)	Ppb	< 5 (Refer Note # 1 below)
Total Ferric Iron	Ppb	< 5
Total Copper	Ppb	Less than 1.0
pH value (runs in H/OH mode)		6.5-7.5
Electric Conductivity after hydrogen column (25^0C)	µS/cm	< 0.1
Chloride (as Cl)	Ppb	<1
Sodium (as Na)	Ppb	< 2
Crud (mostly black oxide of iron)	Ppb	<5

Note-1: For temperature above 50 ^{O} C, the silica value in the effluent shall be based on the resin supplier's recommendations.

Under the Normal Condition, each Condensate Polisher Mixed Bed shall be designed to operate in hydrogen cycle for not less than 168 hours of continuous operation, while maintaining the above treated condensate quality.

(b) START-UP CONDITION

During start up conditions, quality of the influent may deteriorate to:

DESIGN ANALYSIS OF CRUDE CONDENSATE DURING STARTUP CONDITION

CONTAMINANTS	UNIT	INFLUENT
Ammonia	Ppb	1500
Total Dissolved Solids (TDS, ammonia and Silica excluded)	Ppb	2000 approx
Copper	Ppb	-
Total Ferric Iron	Ppb	1000
pH value (polisher runs at 25^0C with H / OH mode)		9.5
Chloride (as Cl)	Ppb	100
Sodium (as Na)	Ppb	20
Silica (as SiO2)	Ppb	150
Crud (mostly black oxide of iron)	Ppb	1000
Conductivity (at 25^0C)	µS/cm	2.0

ANALYSIS OF TREATED CONDENSATE DURING STARTUP CONDITION

CONTAMINANTS	UNIT	EFFLUENT
Total Dissolved Solids	Ppb	< 50
Silica (as SiO2)	Ppb	< 50 (Refer Note # 1 below)
Total Ferric Iron	Ppb	< 100
Total Copper	Ppb	-
pH value (runs in H/OH mode)		6.5-7.5
Electric Conductivity after hydrogen column (25^0C)	µS/cm	< 0.2
Chloride (as Cl)	Ppb	<10

Sodium (as Na)	Ppb	< 5
Crud (mostly black oxide of iron)	Ppb	<150

Note-1: For temperature above 50 ^{O} C, the silica value in the effluent shall be based on the resin supplier's recommendations.

Useful service run under this condition shall be 50 hours before regeneration.

(c) CONDENSER TUBE LEAKAGE CONDITION

Under condenser tube-leakage condition, the plant shall be designed for ingress of 2000 ppb TDS in addition to the normal influent contaminants stated in clause 2.0 (a) above. The Cation and anion loads in 2000 ppb TDS shall be based on the clarified water analysis (Annexure 1) attached.

The analysis of treated condensate under this condition shall be as indicated below:

CONTAMINANTS	UNIT	EFFLUENT
Total Dissolved Solids	Ppb	< 50
Silica (as SiO2)	Ppb	< 50 (Refer Note # 1 below)
Total Ferric Iron	Ppb	< 100
Total Copper	Ppb	-
pH value (runs in H/OH mode)		6.5-7.5
Electric Conductivity after hydrogen column (25^{0}C)	µS/cm	< 0.2
Chloride (as Cl)	Ppb	<10
Sodium (as Na)	Ppb	< 5
Crud (mostly black oxide of iron)	Ppb	<10

Note-1: For temperature above 50 ^{O} C, the silica value in the effluent shall be based on the resin supplier's recommendations.

Useful service run under this condition shall 50 hours before regeneration.

- The bed cross section in the service vessels shall be such that the average velocity of condensate through it shall not exceed 2 meters/min (120 M3/hr/M2) at the design flow rate for cylindrical vessels & 1.75 meters/min (105 M3/hr/M2) at the design flow rate for spherical vessels. The effective depth of mixed bed in condensate polisher service vessel shall be 1100 mm.

- At the design flow rate, the pressure drop between inlet and outlet flanges of the polisher Condensate Polisher Mixed Beds with clean resin bed shall not exceed 2.0 bar. This pressure drop shall include losses due to entrance and exit nozzles, distributors, under drains, resins and the effluent resin traps. Maximum pressure drop under dirty conditions shall be restricted to about 3.5 bar including the pressure drop across effluent resin traps.

- Cation resins shall be regenerated by dilution of technical grade hydrochloric acid to IS: 265 (concentration 30-33% by volume) and anion resins by sodium hydroxide, rayon grade to IS: 252 available as 48% lye. For calculations regeneration temperature should be taken as 25 ^{O} C.

- **EXCHANGE RESINS**

(a) Cation-anion resin ratio shall be 1.5 parts Cation to 1.0 part anion by volume. In case the process require any non ionic resin the same shall represent at least 10% of the bed volume, but not less than 15 cm of the bed depth in the resin separation / cation regeneration tank of the external regeneration facility.

(b) The plant shall include resins for each condensate polisher service vessels along with one (1) spare charge

of resin in the mixed resin storage tank i.e. Four (4) complete charges of resin. A separate charge of resin shall be included for resin injection hopper. Therefore total number of charges shall include total resin charges for TG unit plus one charge in Mixed resin storage Vessel plus one injection hopper charge i.e. five (5).

(c) After Separation anion resin in the cation resin shall be less than 0.1 % and cation resin in the anion resin shall be less than 0.1%.

(d) The resins used for the Condensate Polishing Unit are of the spherical form. Base of the ion-exchange resins shall be copolymer of styrene and divinyl benzene forming a macro porous or macrorecticular structure. Other details are as follows:

- Cation Resin : Strong acid, with sulfonic acid as functional group.
- Anion Resin : Strong base, with quaternary ammonium (Type-I) functional group
- Inert Resin (if required) : Non ionic, compatible with the above resin types

(e) The total wet volume Exchange Capacities shall be based on resin supplier recommendations.
(f) Deration factor of 10% for all resins shall be considered while calculating the quantity of resin to be supplied.
(g) The resin selected must have been in use in Condensate Polishing Plants, capable of producing water as specified or better, for a period of not less than three (3) years.

II. CONDENSATE POLISHING UNITS

Condensate polisher vessel shall consist of following:

- Condensate Polisher vessels complete with condensate inlet and outlet connections, connections for resin transfer to and from the vessels, air distribution arrangement for resin mixing, all fittings and appurtenance as specified and as required.

- External resin traps at the outlet of each of the condensate polisher mixed beds each designed for in-place manual back wash facility.

- Resin transfer header connecting the common external regeneration facilities to the condensate polisher vessels.

- Rinse water outlet headers from condensate polisher vessels of each installation up to the boundary limit of CPU service vessel area.

- All necessary valves and fittings along with the actuators necessary for operation from CP System Control Panel of 800 MW Unit. These shall include suitable arrangement to prevent accidental over pressurization of the resin transfer pipeline and regeneration facilities connected to it, which are designed for pressure much lower than that of the Condensate Polisher Mixed Beds.

- Two (2) nos. Rinse Recirculation Pumps, each complete with electrical drive motor and all other accessories as required.

- Emergency bypass between the condensate influent headers.

- Instrument racks for mounting pressure and flow transmitters, pressure switches, conductivity analyzers, etc. for each of Condensate Polisher Mixed Beds

- Two (2) nos. (1W + 1S) air blowers with electric motor drives for supplying air.

III. EMERGENCY BYPASS SYSTEM

- Condensate polisher service unit shall be provided with an automatic bypass and isolation valves on each side for the condensate polisher on the condensate inlet and outlet headers.

- In the event of pressure differential 0.35 Mpa between the condensate inlet and outlet headers, the control valve will open automatically to bypass requisite quantity of condensate to prevent this pressure differential from exceeding a preset limit when two vessels, one vessel or no vessel is in operation.

- When condensate temperature exceeds 50 deg C the bypass valve shall be 100% opened automatically and

the inlet / outlet of the condensate polisher mixed bed shall be closed to protect elements and resins inside the polisher.

- Either 2X50% capacity valves or 1X100% capacity control valve shall be provided to achieve proper control under all operating conditions.

- The control system shall be so designed that the control valve is able to bypass 50 % of rated flow when any of the service vessel is out of service & 100% when both the service vessels are out of service.

IV. EXTERNAL REGENERATION FACILITY

One common facility for regeneration of the resins from all the condensate polishers shall be provided and consisting of following:

1. Resin Separation & Cation Regeneration Vessel.
2. Anion resin regeneration vessel.
3. Mixed resin storage vessel (if applicable).
   The vessels indicated against sr. no. 1, 2 and 3 above are for reference only. The same shall depend on the supplier recommendations.

4. One (1) no. Resin Injection Hopper, complete with a water ejector system for resin make-up.

5. One (1) nos. Hose Station for Transfer of Hydrochloric Acid. The hose station shall have two (2) nos. each 80 mm NB rubber hose connections.

6. Two (2) nos. Hydrochloric Acid Transfer Pumps each complete with electrical drive motor and all other accessories as required.

7. One (1) no. Hydrochloric Acid Storage Tank complete with integral pipe works, valves and all other accessories as required.

8. One (1) no. Hydrochloric Acid Measuring Tank for Polishers complete with integral pipe works, valves and all other accessories as required.

9. One (1) no. Hose Station for Transfer of Alkali. The hose station shall have two (2) nos. each 80 mm NB rubber hose connections.

10. Two (2) nos. Alkali unloading pumps each complete with electrical drive motor and all other accessories as required.

11. Two (2) nos. Alkali Transfer cum recirculation pumps, each complete with electrical drive motor and all other accessories as required.

12. One (1) no. Activated Carbon Filter for Alkali, complete with internals, integral pipe works, valves and all other accessories as required.

13. One (1) no. Alkali Storage Tank each complete with integral pipe works, valves and all other accessories as required.

14. One (1) no. Alkali Measuring Tank for Polishers complete with internals, integral pipe works, valves and all other accessories as required.

15. Two (2) nos. (2 x 100%) air blowers, each with electric motor drives, V-belt drive with belt guard, air filters, silencers, discharge snubbers, for supply of process air required for regeneration of the resins.

16. One (1) no. Dematerialized Water Storage Tank complete with all accessories.

17. Two (2) nos. DM Water Regeneration / Resin Transfer Pumps each with electric drive motor, one normally operating and the other standby, for water supply for chemical preparation / dosing and transfer of resin from Condensate Polisher Mixed Beds to Regeneration vessels and vice-versa, backwash etc.

18. One (1) no. Water Heater for regeneration of Anion Resins complete with integral pipe works, valves and all other accessories as required.

19. Common Waste Effluent Header with one resin trap designed for in-place manual backwash.

20. One (1) no. Neutralization Pit with two (2) compartments.
21. One (1) no. Acid Measuring Tank for neutralization complete with integral pipe works, valves and all other accessories as required.

22. One (1) no. Alkali Measuring Tank for neutralization complete with integral pipe works, valves and all other accessories as required.

23. Two (2) nos. Neutralized Waste Transfer Pumps, each complete with electrical drive motor.

24. One (1) no. Safety Shower with necessary accessories.

25. DM water piping for dilution, resin transfer, backwashing, flushing, rinsing etc. including the DM water piping along with all supports and hangers between the Regeneration Facility and the CP System.

26. All necessary valves and fittings along with the actuators necessary for their remote automatic operation. These shall include all drains, vents, sampling points with isolation valves as required.

27. All other integral and interconnected pipe works, valves, sump, gates, all types of pipe supports, pipe and cable racks etc. for the entire Plant.

28. Operating platforms, ladders, supports and other structural works as required to facilitate accessibility for operation and maintenance for all the Condensate Polisher Mixed Beds, Regeneration Vessels, Storage Tanks and other equipment.

29. All drive motors / actuators associated with the system / equipment.

30. First fill of resins for all Condensate Polisher Mixed Beds, mixed storage vessel and makeup resin hopper and also first fill of lubricants and grease.

31. All instruments, process switches, analysers, control valves, solenoid valves, etc. as required.

32. All junction and solenoid Boxes.

33. Supply of all screened, instrument and special cables.

34. All cable glands and lugs as required shall be provided.

35. Pneumatic & Process hook up tubing / piping.

36. All anchor bolts, foundation plates sleeves, nuts, inserts, etc. to be embedded in concrete for entire CP System.

V. VESSEL FREEBOARD REQUIREMENTS

The pressure vessels shall be provided with adequate freeboards over the top of the settled resins, to minimize resin loss during their use. An indicative value of free board has been indicated below. However the actual free board will be as per supplier recommendations.

- Mixed bed polisher -100% (only if service vessel is cylindrical in shape)
- Mixed resin Storage vessel (if applicable) - 80%
- Resin separation vessel - 100%
- Cation regeneration vessel - 100%
- Anion regeneration vessel - 100%
- Resin make up hopper - 80%

However if a vessel is used for more than one service, then the vessel design shall be based on the service which gives maximum free board.

VI. TECHNICAL REQUIREMENT OF EQUIPMENTS

(a) RESIN TRAPS

Outlet of each condensate polisher vessel shall be provided with a resin trap. Pressure drop at design flow through a clean resin trap shall not exceed 0.35 kg/sq.cm. Trap shall be of carbon steel constructions with rubber lined and internals shall be of SS-316 construction.

(b) HOT WATER TANK FOR HEATING ALKALI DILUENT WATER

For heating of alkali diluent water 2x50% electrical heating coil in a tank of mild steel rubber lined construction shall be provided. The tank shall be vertical cylindrical type with dished ends. The heaters shall be sized for heating the water from a temperature of 15 deg.C to 50 deg.C at the outlet of ejector. The duration of heating the water shall be five hours.

(c) RESIN TRANSFER PIPELINE LINE

The resin transfer line shall be of stainless steel type SS 304 to ASTM A 312 TP 304 schedule 10S.

(d) EFFLUENT NEUTRALIZATION SYSTEM

Neutralization pit of RCC construction with inside lined with PVC sheet (3 mm thick) shall be provided. Neutralization pit shall be provided in two compartments and each compartment shall have a holding capacity to hold the quantity of waste effluent generated due to single regeneration of Condensate Polisher Mixed Beds of plus 20% overall margin. The regeneration waste shall be led to the N- pit through drain. For further disposal of effluents from CPU Regeneration area N pit two nos (2X100%) Effluent disposal pumps shall be provided.

For sizes below 40 mm NB Stainless Steel Piping to ASTM A 312 TP 304 Sch. 40S shall be provided. The fittings shall be of forged Stainless Steel to ASME SA 182F 304 with SW end to ANSI B 16.11.

Dosing of acid and alkali shall also be provided to neutralize effluents of CPU regeneration waste before disposal to Central Monitoring basin/guard pond.

3.0 BRIEF SCOPE:

3.1 REFER DATA SHEET-A.

4.0 CONTROL & OPERATION OF THE PLANT

The control & operation for the Condensate Polishing Unit shall be Programmable Logic Controller (PLC) based.

This PLC system shall consist of Remote I/O Unit at polisher end and local I/O's & Processor at regeneration area control room. The PLC Remote I/O Unit along with a control panel (to be housed in a suitable enclosure) of Condensate Polisher (CP) system for 800 MW Unit shall be located in the ground floor of Power House. The control of the CP System i.e. service and standby status of Polisher Vessels as well as Resin Transfer from Condensate Polisher Mixed Beds to Regeneration Area and vice versa will be achieved through this PLC. This PLC shall show the operating mode of each Condensate Polisher Mixed Bed (in service, on standby, resin transfer, rinsing down etc.) the position of all automatic valves, operating parameters (such as flow, conductivity, silica levels, differential pressure etc.) and alarm conditions. A mimic diagram shall be provided on the front of the control panel.
Status of various valves shall be indicated by LED's on the mimic diagram.
The control for the external regeneration system shall be from above PLC located in the Control Room at Regeneration Area. One (1) operator work station (OWS) and one (1) operator cum engineering work station (located in common regeneration area) for regeneration system are envisaged. This shall clearly show the status of each concerned Condensate Polisher Mixed Bed. This OWS(in regeneration area) will provide a manually initiated automatic sequence for physical cleaning and chemical regeneration of the resins and show the status of the cycle at all times. This OWS shall also contain all controls and accessories for the acid and alkali solution preparation and dosing system. The regeneration OWS shall also control the sequences of Resin Transfer – i.e. to transfer resin from the Condensate Polisher Mixed Bed to the external regeneration facility and to receive freshly regenerated resin from the regeneration facility– this involves depressurisation of the Condensate Polisher Mixed Bed, water sluicing of exhausted resins to the regeneration system, draining the Condensate Polisher Mixed Bed to the condenser hotwell, receiving a water slurry of fresh resin from the regeneration system and finally completely filling the vessel with condensate.

Thus, a centralized Operation & Control facility of Condensate Polishing Unit system from the regeneration area control room has been envisaged. Status of the measured parameters shall be sent to the central control room for monitoring only. The CPU system shall be time synchronized with GPS using IRIG-B/Ethernet port.

Soft link connectivity between PLC and DCS shall be provided for monitoring of few important parameters. Plc shall be placed in an AC room.
The PLC Remote I/O Unit along with a control panel (to be housed in a suitable enclosure) of Condensate Polisher (CP) system for 800 MW Unit shall be located in the ground floor of Power House.

A) GENERAL

(i) It shall be possible to operate the regeneration plant in Auto / Semi auto / Manual mode. In 'Auto mode, once the sequence has been initiated, it shall proceed from step to step automatically. In 'Semi auto' mode each step shall be performed only after initiation by the operator. In 'manual' mode complete operation shall be by the operator.

(ii) 'Close-Auto-Open' control facility shall be provided from the OWS(in regeneration area) for solenoid valves. In 'Auto' position, the valve shall receive close/open command from the control system.

(iii) The control system shall link the various steps such as closing/ opening of different valves, starting / stopping of various pumps etc which form a sequence. The logic system shall adhere to the correct sequence of operation and predetermined time intervals. The system shall have interlocks so that, criteria necessary for each step are complete prior to proceeding to the next step.

(iv) It shall be possible to switch mode of operation from one to the other at any moment and the operation shall proceed on the newly selected mode from that time.

(v) For steps, which require frequent time adjustment and all other steps, it shall be possible to change the time setting from the OWES.

(vi) For all sequences, the current step number, time of the step, elapsed time of the step and the total elapsed time of the sequences shall be indicated in the OWES.

(vii) The system shall incorporate the necessary safety features. During automatic sequential operation, if any pre-requisite criterion is not fulfilled or missing for a pre determined time interval, the steps shall not proceed further, and alarm shall be provided. Missing criteria, sequence, which is under hold up etc, shall be displayed.

(viii) The safety system for any sequence/step shall check the opening of the required valves and closure of the remaining valves of the plants to avoid mal operation.

(ix) It shall be possible to select each of the CPU vessel for any of the following operations or mode:
- Standby.
- Service.
- Isolation from service.
- Exhausted Resin transfer from CPU vessel to Regeneration plant.
- Regenerated Resin transfer from Regeneration plant to Service vessel.
- Rinse mode.

➢ STANDBY MODE

- Among all the vessels, any one of the vessel maybe selected in this mode.
- Under this mode, the vessel, which was regenerated in the previous cycle and filled with regenerated resin, shall be kept ready for next service cycle.
- The selection of any vessel for standby mode shall be initiated by operator and there shall be indication about details such as "Condition of the resin; whether it is filled with regenerated resin or exhausted resin, whether the standby vessel has undergone rinse cycle or not, data and time of receipt of regenerated resin and completion of rinse cycle.

➢ **SERVICE MODE**

- Flow indicator shall monitor service flow rate for each polishing vessel. During periods of low condensate flow the operator may select to remove one of the vessels from service by a manually initiated automatic sequence.
- A differential pressure transmitter installed between the influent and effluent headers on a high pressure drop signal will cause an alarm and bypass system shall be initiated as described elsewhere.
- By observing the flow out from each individual vessel or conductivity at vessel outlet the operator can determine which vessel is contributing most to the pressure drop and is in need of regeneration.
- Cation conductivity indicators, silica analyzers (multi channel type) & sodium analyzers (multi channel type) shall monitor the discharge of each service vessel. A High influent conductivity alarm will alert the plant operator that a problem condition such as air or condenser cooling water leakage has occurred. This conductivity analyzer shall also provide contacts for an alarm at the power station main control room. A High effluent header or service vessel conductivity alarm will alert the operator to the need for regeneration of a polishing vessel.
- When the vessel under Service mode is ready for regeneration, the operator shall change the same into ‘‘Isolation mode’’ in the respective OWS. Subsequently the ‘‘Standby vessel’’ shall be selected for ‘‘Service mode’’ from the respective OWS. The selection shall follow, required sequence such as pressurization of the vessel, checking of the effluent quality and putting the vessel in service on satisfactory effluent quality

➢ **ISOLATION FROM SERVICE**

Normally ‘‘Service vessel’’ once exhausted shall be isolated from service till the ‘‘Resin Transfer’’ operation is complete.

Exhaustion of a Condensate Polisher Mixed Bed shall be annunciated by any one of the following:

a) High Differential Pressure across the Polisher battery.
b) High effluent Conductivity from an operating vessel.
c) High effluent Silica from an operating vessel.
d) Pre-set volume of condensate treated in an operating vessel.

➢ **EXHAUSTED RESIN TRANSFER FROM CPU VESSEL TO REGENERATION PLANT**

- When a vessel in a ‘‘Service’’ mode needs regeneration as stated above the resin transfer from the particular vessel to the regeneration plant shall be initiated from the OWS(located in regeneration area).
- The transfer of resin from the service vessel shall include operations such as isolation of the service vessel, hydraulic / hydro pneumatic transfer of the resin to the external regeneration system and the complete drain down of the service vessel.
- The sequence of ‘‘Resin Transfer’’ operation shall be initiated and controlled from OWS in the regeneration area.
- The completion of the operation shall be exhibited in the OWS.
- The resin transfer sequence shall be interlocked to prevent resin transfer in any one of the following situations:
  - Unsuccessful completion of a previous chemical regeneration of physical cleaning sequence in the external regeneration system.
  - The Condensate Polisher Mixed Bed condensate inlet and outlet valves not closed.
  - High pressure in the Condensate Polisher Mixed Bed.

➢ **REGENERATED RESIN TRANSFER FROM REGENERATION PLANT TO CPU VESSEL**

- When the regeneration is complete in the regeneration plant, the resin shall be transferred to the empty service vessel of Condensate Polishing Plant.
- This shall be initiated by the operator from the OWS in regeneration area.
- The transfer of resin from the regeneration plant shall include operation such as hydraulic / hydro pneumatic transfer of the resin and the complete drain down of the water.
- The sequence of ‘‘Resin Transfer’’ operation shall be initiated and controlled from OWS in the regeneration area.
- The completion of resin transfer operation shall be exhibited in OWS.

➢ **RINSE MODE**

- After transfer of regenerated resin from the regeneration plant to the empty condensate polisher vessel, this rinse cycle shall be initiated from the OWS of the respective unit so that the vessel may be rinsed and kept ready for next service cycle.
- This sequence shall include the rinse down step using condensate until the unit effluent quality is

acceptable for boiler feed water. Prior to rinsing, the resin shall be given air scrub by means of air blowers provided near the CPP.

- The effluent quality shall be determined by conductivity monitoring of the rinse water outlet.
- Cation conductivity values shall be monitored and interlocked to prevent advancing of the automatic sequence until the rinse down is complete.
- The completion of rinse operation shall be annunciated in the respective OWS and OWES so that the rinse vessel may be selected for ‘‘Standby mode’’ or ‘‘Service mode’’ as per requirement.

B) EXTERNAL REGENERATION CONTROL SYSTEM

- External regeneration system shall be provided to serve the condensate polishing for the unit. This system shall be designed for physical cleaning and chemical regeneration of the resin.
- The control of external regeneration system shall be from the PLC based Operator working cum engineering station (OWES) located in the regeneration area. The PLC based OWES shall interlock to the OWS of the condensate polisher mixed beds based on supplier’s recommendation. The OWES will provide a manually initiated automatic sequence for physical cleaning and chemical regeneration of the resins and show the status of all the cycles at all the times.
- Physical cleaning of the resin shall include three steps, drain to level, air scrub and rinse. The air scrub and rinse steps are of short duration, approximately 1 and 2 to 3 minutes respectively. However the program will allow the operator to increase or decrease the number of times the sequence is repeated to meet the requirements existing at that time.
- The chemical regeneration is a many step sequence. This will include hydraulic reclassification of the resins and the transfer of the resins to the respective regeneration vessels. Following the rinse step the resin shall be given an air scrub followed by a good backwash. The resin is then transferred back to the resin separation vessel and the resins are air mixed. The mixed resins after regeneration are given a final rinse with the discharge conductivity being monitored. The quality of this discharge will determine if the regeneration has been effective. If the quality is not satisfactory the regeneration sequence must be repeated. If satisfactory, the mixed resin is transferred to resin storage vessel.
- A resin mixing and final rinse may occur in the resin storage vessel provided the system design will permit direct return of the resins to the resin separation vessel in the event of unsatisfactory regeneration.

C) SPECIFIC INTERLOCKS RELATED TO SERVICE & REGENERATION SYSTEM

The following interlocks shall be provided:

(i) Service vessels can be back in service, only after they have been pressurized.

(ii) Service vessels can be taken up for resin transfer only after they have been completely isolated from the condensate system and depressurized.

(iii) Resin can be transferred to and from only one service vessel at a time.

(iv) Resin transfer between the service and the regeneration skids shall be permitted only when the receiving vessel is initially empty.

(v) Regeneration sequence can commence, only when the level in the waste NPit is low enough to receive the entire waste water from the regeneration operation.

(vi) Wherever possible, completion of all timed steps in the regeneration and resin transfer process shall be physically verified by effluent conductivity etc as applicable. The automatic sequence shall be prevented from advancing to next step till these required physical conditions are achieved and the same time this delay shall be annunciated to draw the attention of the operator. The automatic sequence of operations shall be interruptive at any time by the operator and he shall be able to take over the control to manual from the steps onwards. Further operator should be able to over ride sequence, if required. It shall be possible for the operator to extend the timing of a particular step by isolating the timer for the duration. The timer will restart once the operators put back the system on auto and the other steps will then follow as programmed.

(vii) The regeneration sequence shall be prevented from advancing further in the event of tripping of a running motor or other fault condition, which do not permit the various desired parameter of this step to be achieved. A manual over ride for this shall also be provided.

(viii) Annunciation logic shall be carefully designed so that the alarms are activated only under abnormal conditions. As for example, low flow of diluent water is only relevant when the chemical dosing is in

progress. All other times, when no diluent water flow is required, this annunciation should be blocked. In general, Normal and trouble free operation of the plant shall not activate any of these alarms.

(ix) Adequate diluent water flow shall be established before starting of the ejectors/dosing pumps for acid and alkali.

(x) The immersion heater in the hot water tank can be put on only when there is adequate water level in the tank.

DATASHEET –A

1.0	**DESCRIPTION OF TURBO GENERATOR UNIT (TG) FOR WHICH CONDENSATE POLISHING IS TO BE PROVIDED :**	
(i)	Number of units	One (1)
(ii)	Capacity of each unit	800 MW
(iii)	Total flow in all the service vessels	1700 Tones per hour
2.0	**CONDENSATE POLISHER SERVICE VESSELS**	
(i)	Number of condensate polisher service vessels	Three(3) [3X50%]
(ii)	Capacity of each condensate polisher service vessel	50% of total condensate flow per unit
(iii)	Design Flow through each condensate polisher service vessel per unit (Net)	850 Tones per hour
(iv)	Design continuous service period between two successive regenerations under different conditions, hrs	As per Technical Specification
(v)	Treated water quality	As per Technical Specification
(vi)	Media inside the vessel	Strongly acidic high capacity polystyrene resin and Type-I strongly basic high capacity.
(vii)	Percentage deration to be considered on design exchange capacity for design of the system	Minimum 10%
(viii)	Depth of the bed, mm	As per Technical Specification
(ix)	Free Board % of Bed Depth	Not less than 100%
(x)	Regenerant Chemical	Dilute Hydrochloric Acid and Dilute Sodium Hydroxide
(xi)	Design flow velocity, m/hr	➢ Not more than 120 for cylindrical vessels. ➢ Not more than 105 for Spherical vessels.
(xii)	Design Temperature	60 degree Celsius
(xiii)	Operating pressure of each condensate polisher service vessel	32 kg/cm2 (a)
(xiv)	Design pressure of each condensate polisher service vessel	47 kg/cm2 (g)
(xv)	Design code of each condensate polisher service vessel	ASME sec VIII div 1/ IS 2825 as applicable
(xvi)	Type of vessels	Cylindrical or spherical
(xvii)	Material of construction	
•	Shell	Carbon steel plates to IS 2062 / SA 515 Gr. 60 or 70 / SA 516 Gr. 60 or 70.
•	Head	Carbon steel plates to IS 2002 Gr. 2A / SA 515 Gr. 60 or 70 / SA 516 Gr. 60 or 70.
(xviii)	Inside protection	Inside lined with Natural Rubber [4.5 mm thick in (3) layers]. The lining shall be of rubber having a hardness of 65 plus/minus 5 shore-A meeting the requirements of IS: 4682, Part-I.
(xix)	Material of Construction of Inlet water distributor & Under drains	• Inlet water distributor: - Hub and internals diffuser splash plate or header and perforated laterals. Material of construction shall be SS-316 • Under drains: - Same as above with screened laterals with internal perforated pipes and rubber lined flat bottom.
2.1	**RINSE RECIRCULATION PUMPS**	
(i)	Number	Two (2x100%) (1 working + 1 standby)
(ii)	Type	Horizontal, centrifugal
(iii)	Service	Intermittent
(iv)	Rated capacity, Cu.m/hr.	To be selected by the Bidder as necessary to meet the system requirements.
(v)	Head to be developed	To be selected by the Bidder as necessary to meet the system requirements.

(vi)	Suction condition	Flooded
(vii)	Material of construction	
	• Casing	Stainless Steel type 316
	• Impeller	Stainless Steel type 316
	• Shaft	Stainless Steel type 410
(viii)	Packing seal	Mechanical type
(ix)	Pump Speed	Maximum 1500 rpm
(x)	Whether suction strainer required	Yes (Material of construction – SS316)
(xi)	Accessories required for each	Common base plate, coupling guards, drain plug, vent valve, suction hoses, isolation valves, Y-type strainers etc.
(xii)	Pressure dampener	One number per pump
2.2	**AIR-BLOWERS FOR RESIN MIXING (SERVICE VESSELS AREA)**	
(i)	Number per unit	Two (2x100%) (1 working + 1 standby)
(ii)	Type	Rotary, Twin Lobe, oil free, positive displacement
(iii)	Service	Intermittent
(iv)	Capacity and head	As required
(v)	Pressure gauge	One per blower
(vi)	Material of construction	• Casing – Cast Iron • Lobe – Cast Iron • Shaft – Carbon steel to EN 8
(vii)	Accessories	Each blower shall be complete with motor, V-belt drive with belt guard, inlet filter/silencer, flexible couplings and discharge snubber, all mounted on a single base. Relief valve(s) shall also be provided by the bidder.
3.0	**EXTERNAL REGENERATION FACILITIES**	
3.1	**REGENERATION VESSELS**	
a.	**RESIN SEPARATION AND CATION RESIN REGENERATION VESSEL**	
(i)	Number	One (1) number vessel
(ii)	Depth of the bed, mm	As per Technical Specification
(iii)	Free Board % of Bed Depth	Not less than 100%
(iv)	Design Temperature	60 degree Celsius
(v)	Design Pressure	Design pressure shall be the maximum expected pressure to which the vessel may be subjected plus 5% extra margin. Maximum expected pressure for vessels placed in the discharge line of pumps shall be based on the shut-off head of the pumps plus static head at pump suction.
(vi)	Material of construction	
	• Shell	Carbon steel plates to IS 2062 / SA 515 Gr. 60 or 70 / SA 516 Gr. 60 or 70.
	• Head	Carbon steel plates to IS 2002 Gr. 2A / SA 515 Gr. 60 or 70 / SA 516 Gr. 60 or 70.
(vii)	Inside protection	Inside lined with Natural Rubber [4.5 mm thick in (3) layers]. The lining shall be of rubber having a hardness of 65 plus/minus 5 shore-A meeting the requirements of IS: 4682, Part-I.
(viii)	Design code	ASME sec VIII div 1/ IS 2825 as applicable
(ix)	Accessories	Operating platforms, manholes, ladders, supports, lifting lugs (4 nos minimum) and other structural works for each regeneration vessel to facilitate accessibility for operation and other equipments etc.
b.	**CATION RESIN REGENERATION VESSEL**	
(i)	Number	One (1) number vessel
(ii)	Depth of the bed, mm	As per Technical Specification
(iii)	Free Board % of Bed Depth	Not less than 100%
(iv)	Design Temperature	60 degree Celsius

(v)	Design Pressure	Design pressure shall be the maximum expected pressure to which the vessel may be subjected plus 5% extra margin. Maximum expected pressure for vessels placed in the discharge line of pumps shall be based on the shut-off head of the pumps plus static head at pump suction.
(vi)	Material of construction	
	• Shell	Carbon steel plates to IS 2062 / SA 515 Gr. 60 or 70 / SA 516 Gr. 60 or 70.
	• Head	Carbon steel plates to IS 2002 Gr. 2A / SA 515 Gr. 60 or 70 / SA 516 Gr. 60 or 70.
(vii)	Inside protection	Inside lined with Natural Rubber [4.5 mm thick in (3) layers]. The lining shall be of rubber having a hardness of 65 plus/minus 5 shore-A meeting the requirements of IS: 4682, Part-I.
(viii)	Design code	ASME sec VIII div 1/ IS 2825 as applicable
(ix)	Accessories	Operating platforms, manholes, ladders, supports, lifting lugs (4 nos minimum) and other structural works for each regeneration vessel to facilitate accessibility for operation and other equipments etc.
c.	**RESIN ISOLATION VESSEL**	
(i)	Number	One (1) number vessel
(ii)	Depth of the bed, mm	As per Technical Specification
(iii)	Free Board % of Bed Depth	Not less than 100%
(iv)	Design Temperature	60 degree Celsius
(v)	Design Pressure	Design pressure shall be the maximum expected pressure to which the vessel may be subjected plus 5% extra margin. Maximum expected pressure for vessels placed in the discharge line of pumps shall be based on the shut-off head of the pumps plus static head at pump suction.
(vi)	Material of construction	
	• Shell	Carbon steel plates to IS 2062 / SA 515 Gr. 60 or 70 / SA 516 Gr. 60 or 70.
	• Head	Carbon steel plates to IS 2002 Gr. 2A / SA 515 Gr. 60 or 70 / SA 516 Gr. 60 or 70.
(vii)	Inside protection	Inside lined with Natural Rubber [4.5 mm thick in (3) layers]. The lining shall be of rubber having a hardness of 65 plus/minus 5 shore-A meeting the requirements of IS: 4682, Part-I.
(viii)	Design code	ASME sec VIII div 1/ IS 2825 as applicable
(ix)	Accessories	Operating platforms, manholes, ladders, supports, lifting lugs (4 nos minimum) and other structural works for each regeneration vessel to facilitate accessibility for operation and other equipments etc.
d.	**MIXED RESIN STORAGE VESSEL**	
(i)	Number	One (1) number vessel
(ii)	Depth of the bed, mm	As per Technical Specification
(iii)	Free Board % of Bed Depth	Not less than 100%
(iv)	Design Temperature	60 degree Celsius
(v)	Design Pressure	Design pressure shall be the maximum expected pressure to which the vessel may be subjected plus 5% extra margin. Maximum expected pressure for vessels placed in the discharge line of pumps shall be based on the shut-off head of the pumps plus static head at pump suction.
(vi)	Material of construction	
	• Shell	Carbon steel plates to IS 2062 / SA 515 Gr. 60 or 70 / SA 516 Gr. 60 or 70.
	• Head	Carbon steel plates to IS 2002 Gr. 2A / SA 515 Gr. 60 or 70 / SA 516 Gr. 60 or 70.

(vii)	Inside protection	Inside lined with Natural Rubber [4.5 mm thick in (3) layers]. The lining shall be of rubber having a hardness of 65 plus/minus 5 shore-A meeting the requirements of IS: 4682, Part-I.	
(viii)	Design code	ASME sec VIII div 1 / IS 2825 as applicable	
(ix)	Accessories	Operating platforms, manholes, ladders, supports, lifting lugs (4 nos minimum) and other structural works for each regeneration vessel to facilitate accessibility for operation and other equipments etc.	
	The vessels indicated against sr. no. a, b, c and d above are for reference only. The same shall depend on the supplier recommendations.		
3.2	**BULK ACID AND ALKALI STORAGE TANKS**		
(i)	**CHEMICAL TANKS**	**HYDROCHLORIC ACID STORAGE TANK**	**ALKALI STORAGE TANKS**
(ii)	Number required	One(1)	One(1)
(iii)	Design code	--------As per BSEN : 12285 or equivalent ----------	
(iv)	Location	----------Outdoor----------	
(v)	Useful capacity	Adequate to hold the quantity of commercial Acid required for thirty (30) days of operation.	Adequate to hold the quantity of commercial Alkali required for thirty (30) days of operation.
(vi)	Type	-----Horizontal cylindrical with dished ends, atmospheric, over ground-------	
(vii)	Material of construction	• Shell - IS 2062 / SA 515 Gr. 60 or 70 / SA 516 Gr. 60 or 70. • Dished Ends- IS 2002 Gr. 2A / SA 515 Gr. 60 or 70 / SA 516 Gr. 60 or 70. • Inside lined with Natural Rubber [4.5 mm thick in (3) layers]. The lining shall be of rubber having a hardness of 65 plus/minus 5 shore-A meeting the requirements of IS: 4682, Part-I.	
(viii)	Type of fluid to be handled	30 - 33 % Hydrochloric Acid	40 - 48 % Sodium Hydroxide
(ix)	Accessories for each tank	Fume absorbers (for acid storage tank), carbon dioxide absorber (for alkali storage tank), manholes, vent, overflow, drain, sample connection, operating platform, ladders, lifting lugs (4 nos. minimum) etc.	
3.3	**ACID AND ALKALI UNLOADING / TRANSFER PUMPS**		
(i)	**PUMPS**	**ACID UNLOADING /TRANSFER PUMPS**	**ALKALI UNLOADING /TRANSFER PUMPS**
(ii)	Number required	Two (2x100%) (1 working + 1 standby)	Two (2x100%) (1 working + 1 standby)
(iii)	Type	----------Horizontal Centrifugal----------	
(iv)	Service	----------Intermittent----------	
(v)	Location	----------Outdoor----------	
(vi)	Rated Capacity and head (minimum)	----------10 cum / hr and 10 mlc----------	
(vii)	Liquid to be handled	30 -33 % HCL	40-48% NaOH
(viii)	Material of construction	• Casing- Polypropylene. • Impeller- Polypropylene. • Shaft- Hardened Carbon steel –EN8.	• Casing- Stainless Steel type 304. • Impeller- Stainless Steel type 304. • Shaft-– Stainless Steel type 410.
(ix)	Pressure Dampener	One per pump	One per pump
(x)	Type of shaft sealing	Mechanical Seal	Mechanical Seal
(xi)	Reinforced rubber hosed	Two nos of size 80 NB with minimum 20 meters length.	Two nos of size 80 NB with minimum 20 meters length.
(xii)	Whether suction strainer required	Yes (Material of construction – polypropylene)	Yes (Material of construction – SS316)

(xiii)	Accessories required for each pump	Coupling guard, drain plug, vent valve, suction hoses, isolation valves, Y- type strainers, pressure gauges, pulsation dampener etc.	
3.4	**CHEMICAL HANDLING, PREPARATION & DOSING SYSTEM**		
a)	**ALKALI TRANSFER PUMPS**		
(i)	Nos. required	Two (2x100%) (1 working + 1 standby)	
(ii)	Type	Horizontal, centrifugal	
(iii)	Service	Intermittent	
(iv)	Type of fluid to be handled	5-48% Sodium Hydroxide (NaOH)	
(v)	Rated Capacity & head (minimum)	10 M3/hr, 10 MLC	
(vi)	Suction condition	Flooded	
(vii)	Materials of construction		
•	Casing	Stainless Steel type 304.	
•	Impeller	Stainless Steel type 304.	
•	Shaft	Stainless Steel type 304.	
(viii)	Pressure Dampener	One per pump	
(ix)	Whether suction strainer required	Yes (Material of construction – SS316)	
(x)	Type of shaft sealing	Mechanical Seal	
(xi)	Accessories required for each pump	Coupling guard, drain plug, vent valve, isolation valves, y- type strainers, pressure gauges, pulsation dampener etc.	
b)	**CHEMICAL TANKS**	**ACID MEASURING TANK**	**ALKALI MEASURING TANK**
(i)	Number required	One (1)	One (1)
(ii)	Type	----Vertical cylindrical with flat bottom, over-ground , atmospheric----	
(iii)	Type of fluid to be handled	30 - 33 % Hydrochloric Acid	40 - 48 % Sodium Hydroxide
(iv)	Useful capacity	Adequate to hold the quantity of Acid required for single regeneration of a Condensate Polisher Mixed Bed with 20% overall margin.	Adequate to hold the quantity of Alkali required for single regeneration of a Condensate Polisher Mixed Bed with 20% overall margin.
(v)	Stirrer	Not applicable	Slow speed stirrer driven by motor drive and reduction gear. Speed of stirrer = 200 rpm max Material of Construction of each stirrer and agitator = Stainless Steel – 316.
(vi)	Dissolving Basket per tank	Not applicable	(50-60 mesh B.S.) Material of Construction of each Dissolving Basket = Stainless Steel 316.
(vii)	Materials of construction	• Shell - IS 2062 / SA 515 Gr. 60 or 70 / SA 516 Gr. 60 or 70. • Flat Bottom- IS 2002 Gr. 2A / SA 515 Gr. 60 or 70 / SA 516 Gr. 60 or 70. • Inside lined with Natural Rubber [4.5 mm thick in (3) layers]. The lining shall be of rubber having a hardness of 65 plus/minus 5 shore-A meeting the requirements of IS: 4682, Part-I.	
(viii)	Accessories for each tank	Fume absorbers (for acid measuring tank), carbon dioxide absorber (for alkali measuring tank), vent, overflow, drain, sample connection, operating platform, ladders, lifting lugs (4 nos. minimum) etc.	

c)	**DOSING PUMPS**	**ACID DOSING PUMPS**	**ALKALI DOSING PUMPS**
(i)	Number	Two (2x100%) (1 working + 1 standby)	Two (2x100%) (1 working + 1 standby)
(ii)	Type	------Hydraulically operated diaphragm type---------	
(iii)	Material of construction of wetted parts of pumps	Polypropylene	Stainless Steel 304
(iv)	Range of operation (%)	0-100	0-100
(v)	Whether suction strainer required	Yes (Material of construction – polypropylene)	Yes (Material of construction – SS316)
(vi)	Maximum pump stroke speed per minute	---------- 100 ----------	
(vii)	Pressure Dampener	One per pump	One per pump
(viii)	External safety relief valve (in addition to inbuilt safety valve)	Two numbers. Material of construction of each safety relief valve shall be Polypropylene	Two numbers. Material of construction of each safety relief valve shall be SS316
(ix)	Capacity & Head	Capable of meeting regeneration of one cation/Anion and one mixed bed unit; head as required (with 20% margin).	
(x)	Accessories required for each pump	Coupling guard, drain plug, vent valve, isolation valves, Y- type strainers, pressure gauges, pulsation dampener etc.	
3.5	**ACTIVATED CARBON FILTER FOR ALKALI**		
(i)	Number	One (1)	
(ii)	Type	Vertical cylindrical with dished end bottom	
(iii)	Design Pressure	Design pressure shall be the maximum expected pressure to which the vessel may be subjected plus 5% extra margin. Maximum expected pressure for vessels placed in the discharge line of pumps shall be based on the shut-off head of the pumps plus static head at pump suction.	
(iv)	Capacity	Not less than 10 m3/hr	
(v)	Velocity	Not less than 15m/hr	
(vi)	Bed depth (minimum)	1200mm activated carbon + 300mm Gravel support	
(vii)	Material of construction		
	• Shell	Carbon steel plates to IS 2062 / SA 515 Gr. 60 or 70 / SA 516 Gr. 60 or 70.	
	• Head	Carbon steel plates to IS 2002 Gr. 2A / SA 515 Gr. 60 or 70 / SA 516 Gr. 60 or 70.	
(viii)	Inside protection	Inside lined with Natural Rubber [4.5 mm thick in (3) layers]. The lining shall be of rubber having a hardness of 65 plus/minus 5 shore-A meeting the requirements of IS: 4682, Part-I.	
(ix)	Design code	ASME sec VIII div 1 / IS 2825 as applicable	
(x)	Influent Distributor Material	SS 316	
(xi)	Manhole	Two (2) nos minimum each of Davit type and 500 mm dia.	
(xii)	Sight Windows	One (1) no. in backwash space	
(xiii)	Hand hole	One (1) no. of 150 mm dia for removal of activated carbon	
(xiv)	Accessories	Manhole, vent, drain, sample connection, level transmitter, operating platform, ladders, lifting lugs (4 Nos minimum) etc.	
(xv)	Filter Media		
•	Type	Activated carbon	
•	Characteristics of Activated Carbon	Total Surface area	Not less than 850 sq.m/gm.
		Bulk density	Not less than 400 kg/cu.m.
		Iodine number	850 minimum
		Uniformity coefficient	1.9 or less
		Abrasion number	70 minimum
		Ash	8% maximum

3.6	**ALKALI DILUENT WATER HEATING TANK (HOT WATER TANK)**	
(i)	Number	One (1)
(ii)	Type	Vertical Cylindrical with dished end with Electric heater
(iii)	Effective capacity	Suitable to meet the requirements for alkali injection and alkali displacement in course of single regeneration of a Condensate Polisher Mixed Bed, plus 20% margin.
(iv)	Temperature of alkali to be heated	To obtain temp of 50^{O}C at alkali mixing feed out let.
(v)	Design Pressure	Design pressure shall be the maximum expected pressure to which the vessel may be subjected plus 5% extra margin. Maximum expected pressure for vessels placed in the discharge line of pumps shall be based on the shut-off head of the pumps plus static head at pump suction.
(vi)	Material of construction	
	• Shell	Carbon steel plates to IS 2062 / SA 515 Gr. 60 or 70 / SA 516 Gr. 60 or 70 or SS304.
	• Dished ends	Carbon steel plates to IS 2002 Gr. 2A / SA 515 Gr. 60 or 70 / SA 516 Gr. 60 or 70 or SS304.
(vii)	Inside protection	Inside lined with Natural Rubber [8.0 mm thick in (6) layers] Suitable for temperature 70 ^{0} C. Rubber lining shall not be applicable in case of SS304 material.
(viii)	Design code	ASME sec VIII div 1 / IS 2825 as applicable
(ix)	Temperature gauge	To be provided by the bidder
(x)	Temp. transmitters	To be provided by the bidder
(xi)	Burn out protection	To be provided by the bidder
(xii)	Accessories	Manhole, vent, drain, sample connection, level transmitter, operating platform, ladders, lifting lugs (4 Nos minimum) etc.
3.7	**D.M. WATER PUMPS FOR REGENERATION AND RESIN TRANSFER**	
(i)	Number	Two (2x100%) (1 working + 1 standby)
(ii)	Type	Horizontal, centrifugal
(iii)	Service	Intermittent
(iv)	Capacity & head	As required
(v)	Suction condition	Flooded
(vi)	Material of construction	
•	Casing	Stainless Steel type 316
•	Impeller	Stainless Steel type 316
•	Shaft	Stainless Steel type 410
(vii)	'Y' type strainer	One number per pump (Material shall be SS316)
(viii)	Packing seal	Mechanical type
(ix)	Pump Speed	Maximum 1500 rpm
(x)	Whether suction strainer required	Yes (Material of construction – SS316)
(xi)	Accessories required for each	Common base plate, coupling guards, drain plug, vent valve, suction hoses, isolation valves, Y-type strainers etc.
(xii)	Pressure dampener	One number per pump
3.8	**AIR-BLOWERS FOR RESIN MIXING (REGENERATION AREA)**	
(i)	Number	Two (2x100%) (1 working + 1 standby)
(ii)	Type	Rotary, Twin Lobe, oil free, positive displacement
(iii)	Service	Intermittent
(iv)	Capacity and head	As required
(v)	Material of construction	Casing – Cast Iron Lobe – Cast Iron Shaft – Carbon steel to EN 8

(vi)	Accessories	Each blower shall be complete with motor, V-belt drive with belt guard, inlet filter/silencer, flexible couplings and discharge snubber, all mounted on a single base. Relief valve(s) shall also be provided by the bidder.	
4.0	**NEUTRALISING SYSTEM**		
4.1	**NEUTRALIZATION PIT**		
(i)	Number	One (1) no. Pit with two (2) compartments	
(ii)	Type	Necessary air grid arrangement of polypropylene construction shall be provided in each compartment for effective neutralization of the waste effluent.	
(iii)	Capacity of each compartment	Adequate to hold the quantity of waste effluent generated due to single regeneration of Condensate Polisher Mixed Beds of plus 20% overall margin.	
(iv)	Material of Construction	RCC .Minimum Inside lined with PVC sheet (3 mm thick).	
(v)	No. of compartments	Two compartments	
4.2	**NEUTRALIZATION PIT DISPOSAL PUMPS**		
(i)	Number	Two (2x100%) (1 working + 1 standby)	
(ii)	Type	Horizontal Centrifugal	
(iii)	Service	Intermittent	
(iv)	Rated capacity, Cu.m/hr.	50 minimum (To be increased by the Bidder if necessary to transfer the waste of single regeneration of the resins of a Condensate Polisher Mixed Bed within four (4) hours)	
(v)	Head to be developed	40 minimum (To be increased by the Bidder if necessary to meet the system requirements)	
(vi)	Material of construction of wetted parts of pumps		
	• Casing	Stainless Steel type 316	
	• Impeller	Stainless Steel type 316	
	• Shaft	Stainless Steel type 410	
(vii)	Suction Condition	Suction from priming Chamber/ Submerged (Suction from pit)	
(viii)	Number of priming chamber	Two	
(ix)	Pressure gauge	One number per pump with Teflon diaphragm seal	
(x)	Whether suction strainer required	Yes (Material of construction – SS316)	
(xi)	Pressure dampener	One number per pump	
(xii)	Accessories required for each pump	Coupling guard, drain plug, vent valve, suction hoses, isolation valves, 'Y' type strainer, pressure gauges, pulsation dampener etc.	
4.3	**CHEMICAL TANKS FOR NEUTRALIZATION PIT**	**ACID MEASURING TANK**	**ALKALI MEASURING TANK**
(i)	Number required	One (1)	One (1)
(ii)	Type	----Vertical cylindrical with flat bottom, over-ground , atmospheric----	
(iii)	Type of fluid to be handled	30 -33 % HCl	40-48 % NaOH
(iv)	Useful capacity	Adequate to hold the quantity of alkali required for neutralization of excess acid in waste effluent due to single regeneration of a Condensate Polisher Mixed Bed with 20% overall margin.	Adequate to hold the quantity of acid required for neutralization of excess alkali in waste effluent due to single regeneration of a Condensate Polisher Mixed Bed with 20% overall margin.

(v)	Stirrer	Not applicable	Slow speed stirrer driven by motor drive and reduction gear. Speed of stirrer = 200 rpm max Material of Construction of each stirrer and agitator = Stainless Steel – 316.
(vi)	Dissolving Basket per tank	Not applicable	(50-60 mesh B.S.) Material of Construction of each Dissolving Basket = Stainless Steel 316.
(vii)	Materials of construction	• Shell - IS 2062 / SA 515 Gr. 60 or 70 / SA 516 Gr. 60 or 70. • Flat Bottom- IS 2002 Gr. 2A / SA 515 Gr. 60 or 70 / SA 516 Gr. 60 or 70. • Inside lined with Natural Rubber [4.5 mm thick in (3) layers]. The lining shall be of rubber having a hardness of 65 plus/minus 5 shore-A meeting the requirements of IS: 4682, Part-I.	
(viii)	Accessories for each tank	Fume absorbers (for acid measuring tank), carbon dioxide absorber (for alkali measuring tank), vent, overflow, drain, sample connection, operating platform, ladders, lifting lugs (4 nos. minimum) etc.	
5.0	**DEMINERALIZED WATER STORAGE TANK**		
A)	Numbers To be provided	One (1).	
B)	Description for each Tank		
(i)	Type	Vertical cylindrical with flat bottom.	
(ii)	Type of fluid to be handled	Demineralized Water.	
(iii)	Effective capacity, in m3	500 or the quantity of DM Water as required for complete single regeneration/ transfer of ion exchange resins (from Polisher Area to Regeneration Area and vice versa) contained in a Polisher Vessel, whichever is more.	
(iv)	Minimum Free Board, in mm	500.	
(v)	Design Pressure, Kg/cm2.g	Atmospheric	
(vi)	Design Temperature, °C	60	
(vii)	Design Code	IS-803	
(viii)	Material of Construction		
	• Shell	Carbon steel as per IS 2062	
	• Roof and Bottom	Carbon steel as per IS 2062	
(ix)	Thickness, in mm	Min 8 mm thick for bottom plate and first run at bottom part of the shell height. Subsequent upper run of the shell height may be Min 6 mm thick.	
(x)	Protection		
	• Internal	Epoxy painted	
(xi)	Manhole	Two (2) on shell and roof – Each of minimum 500 mm NB and Davit type.	
(xii)	Instruments along with alarms, interlocks and accessories	To be provided by the bidder as per the requirements of the Tender Specification and Drawings, enclosed with it.	
(xiii)	Testing and Inspection	Shall be in line with Specification/approved field quality plans and relevant IS codes	
6.0	**PIPING**		
(i)	Resin Transfer piping	ASTM A 312 TP 304 schedule 10S	
(ii)	DM water line	Carbon Steel Rubber Lined to IS 1239 heavy grade for sizes 40 mm NB and above.	
(iii)	Service vessel Inlet, Outlet, and bypass line.	ASTM A 106 Gr. B	
(iv)	Rinse Line	ASTM A 106 Gr. B	
(v)	Neutralised effluent	Rubber lined ERW carbon steel pipe to ASTM A53 Gr. B/IS-1239, Part-I, Heavy grade (see Note-2 below).	

(vi)	Hydrochloric acid (at all concentration)	Rubber lined ERW carbon steel pipe to ASTM A53 Gr. B/IS-1239, Part-I, Heavy grade (see Note-2 below).
(vii)	Sodium hydroxide (at all con-centration)	Rubber lined ERW carbon steel pipe to ASTM A53 Gr. B/IS-1239, Part-I, Heavy grade (see Note-2 below).
(viii)	Sampling Pipe	Stainless Steel to ASTM Schedule-10.
(ix)	Service Air, Instrument Air	Galvanised Steel Pipe to ASTM 53 Gr. B/IS: 1239, Part-I, heavy grade.
(x)	Service water	ERW Carbon Steel Pipe to ASTM 53 Gr. B / IS-1239, Part-I heavy grade for pipe size up to 150mm NB and IS-3589 for 200mm NB & above

1. For demineralised water, stainless steel shall be used for sizes of 50mm NB and below.
2. For small diameter pipe (<=40NB), where rubber lining is difficult, CPVC PN 10 shall be used for hydrochloric acid and stainless steel pipe to ASTM A 312 TP 304 Sch. 40S instead of rubber lined steel pipe shall be used for other services.

7.0	**VALVES**	
7.1	**BUTTERFLY VALVES**	Butterfly valves shall be of double flanged or lugged wafer type of low leakage rate confirming to AWWA-C-504 class 300 (min.) or BS:5155 PN 10 (min.) Condensate polishing plant outlet butterfly valves shall be of stainless steel construction, SS-316 (for body, disc and shaft). Condensate polishing plant inlet butterfly valves shall be of Carbon Steel construction. For DM water services stainless steel body valves to ASTM A 351 Gr. 351 Gr. CF8M or CI body with suitable elastomer/rubberlining for wall internal and/or disc shall be provided. The type of valve for DM water application shall be diaphragm valve or rubber lined butterfly valves. All the butterfly valves shall be provided with Hand wheel or lever as per the requirements. For larger sizes i.e. 150 NB and above hand wheel shall be provided. For lever/wrench operated valves, means shall be provided by the bidder for positively holding the disc in not less than three intermediate positions. Manually operated valves shall be provided by the bidder with reduction gear unit for valves of size 250 NB and above. Valve provided with motorised or pneumatic actuator shall be provided by the bidder with a hand wheel for manual operation. All the valves shall be equipped with adjustable mechanical stop-limiting devices to prevent over travel of the valve disc in the open and closed positions. The valve operators (Handwheel or Gear reduction unit or Motor actuator etc.) shall be designed as per relevant International Standard. All the butterfly valves shall be provided by the bidder with an indicator to show the position of the disc. Flanges shall conform to ANSI B 16.5 Cl.300 (min.) Butter fly valves at the by pass line of service vessel shall be flangeless wafer type (A216 WCB)

7.2	**DIAPHRAGM VALVE**	The Diaphragm shall conform to following requirement for DM water application i) Design standard: BS:5156 or equivalent of required rating/class. (minimum rating of valves shall be PN 10). ii) Type: Flanged and lined body ends, sealed bonnet, weir pattern, tight shut off type iii) Material of Construction a. Body , Bonnet: Cast iron IS 210 Gr. FG 260 or equivalent or Cast steel ASTM A-216 Gr. WCB b. Body lining : Soft natural rubber, ebonite , Polypropelene c. Handwheel : Cast Iron d. Compressor : Stainless Steel e. Stem and Bush : Stainless Steel For Acid and Alkali services the valve shall conform to above (as mentioned for DM water) except that the diaphragm shall be of reinforced Teflon , EPDM/Black Butyl/ approved equivalent for acid services and reinforced neoprene/Hypalon/approved equivalent for alkali services.
7.3	**ECCENTRIC PLUG VALVE/ BALL VALVE**	These valves shall be used for resin transfer line. These valves shall be flanged type and of SS 316 construction.
7.4	**NON RETURN VALVES (NRV)**	For hydrochloric acid services, NRV shall be of swing check type/dual plate/lift ball check type of suitable material or as per manufacturer's standard. For alkali and DM services, complete valve shall be of SS-316 & SS-304 construction respectively.
8.0	**SAFETY EQUIPMENT**	Ten (10) sets of safety equipment [(Personal Protection Equipment (PPE)] comprising PVC protection suits with hoods, rubber boots, face visors and thick PVC gauntlets shall also be provided by bidder. A personnel water drench shower/safety shower and eye bath shall also be provided by the bidder.

PUMPS AND PIPE SELECTION CRITERIA

		Velocity in m/sec.		
		Pipe Size		
Sr. No.	**Pipe Size**	**Below 50 mm**	**50 - 150 mm**	**200 mm & above**
a)	Pump Suction for Water	-	1.2 - 1.5	1.2 - 1.8
b)	Pump Discharge for Water	1.2 - 1.8	1.8 - 2.5	2.1 -2.5
c)	Header for Water	-	1.5 - 2.4	2.1 - 2.4
d)	Pump suction for chemical solution	0.8 - 1.2	0.8 - 1.3	-
e)	Pump discharge for chemical solution	1.2 - 1.4	1.3 – 1.5	-
f)	Compressed air below 2 kg. /sq.cm(g)	15 - 20	20 - 30	25 - 35
g)	Compressed air [2 kg. /sq.cm (g) & above]	20 - 30	25 - 40	35 - 45

The velocity limits for calculating the inside diameters are listed below:

1. Condensate Inlet Pipe from CEP Discharge Header : 5.0 M/sec.
2. Header for Condensate : 5.0 M/sec.
3. CPU bypass line : 5.0 M/sec.