

1X800 MW GSECL, WANAKBORI TPP, UNIT NO. 8.

VOLUME: II B & III

**TECHNICAL SPECIFICATIONS
FOR
EFFLUENT TREATMENT PLANT**

SPECIFICATION NO.: PE-TS-408-164-A001



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



**1x800 MW WANAKBORI STPP
TECHNICAL SPECIFICATION FOR
EFFLUENT TREATMENT PLANT
INDEX**

SPECIFICATION No: PE-TS-408-164-A001

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b	KEY PLAN	PE-DG-408-164-A002
c	PLANT WATER P&ID	PE-DG-408-172-N001
d	PLOT PLAN	PE-DG-408-100-M001



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SECTION-A

INTENT OF SPECIFICATION



**1x800 MW WANAKBORI STPP
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1.0 INTENT OF SPECIFICATION

- 1.1** The specification is intended to cover design, engineering, manufacture, fabrication, assembly, Civil Design, structural and construction works at site for all equipment including road and pathway/walkway, inspection and testing at vendor's & sub-vendor's works, painting, mandatory spares along with spares for erection and commissioning, startup and commissioning as required, forwarding, proper packing, shipment and delivery at site, unloading, handling & transportation at site, Erection & Commissioning, trial run, on FOR site basis, preparation & submission of "As Built" drawings, PG test at site and handing over of **Effluent Treatment Plant** as per the details in different sections / volumes of this specification for **1X800 MW WANAKBORI STP** at Wanakbori, Gujarat.
- 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 of **Effluent Treatment Plant**.
- 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 highest 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. Similarly, the extent of supply also includes all terms required for completion of the system and not withstanding that they may have been omitted in drawings / specifications or schedules.
- 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



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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 the event of any conflict between the requirements of two clauses of this specification documents or requirements of different codes and standards specified, Section - C shall prevail over section – D and Section-C1, C3, C4 & C5 shall prevail over Section-C2, however more stringent requirement as per the interpretation of the owner shall apply.
- 1.10 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.
- 1.11 For definition of word like Contractor, bidder, supplier, vendor, Customer/ Purchaser / Employer, consultant, please referred relevant clause(s) of GCC.



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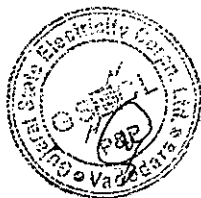
SECTION: B

**PROJECT INFORMATION WITH WIND AND SEISMIC DESIGN
CRITERIA**

VOLUME : IIA

SECTION-II

PROJECT SYNOPSIS AND GENERAL INFORMATION



DEVELOPMENT CONSULTANTS
(K9213R-EPC-SPC-001-Vol-IIA-Sec-1&2)

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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.

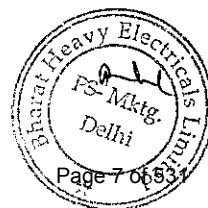
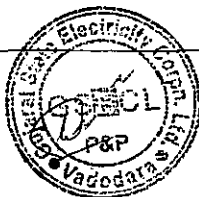
Nearby Air Ports are Ahmedabad at a distance of about 110 kilometers from the site and Vadodara at a distance of about 85 kilometers from the site.

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.



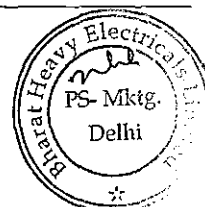
CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	INTRODUCTION
2.00.00	APPROACH TO SITE
3.00.00	LAND
4.00.00	SOURCE OF COAL
5.00.00	SOURCE OF WATER
6.00.00	ASH DISPOSAL AREA
7.00.00	SALIENT DESIGN DATA



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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

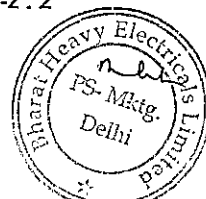
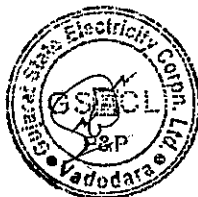
Existing Ash Pond / Dyke area will be utilized for the extension unit. Fly ash silos will be located outside plant boundary wall (but within GSECL land) in the vicinity of the Ash Dyke area.

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

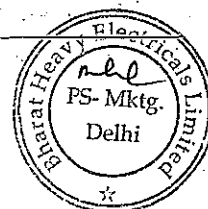
[Metrological data of Vadodara is attached for reference].



VOLUME : IIA
SECTION-IX
SALIENT DESIGN DATA
[TABLE-I TO TABLE-VII]



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TABLE-III	ESTIMATION OF CONSUMPTIVE WATER REQUIREMENT
TABLE-IV	ANALYSIS OF COAL
TABLE-V	ASH ANALYSIS
TABLE-VI	FUEL OIL ANALYSIS
TABLE-VII	CLIMATOLOGICAL TABLE OF BARODA

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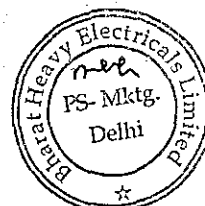
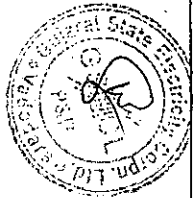


TABLE-III

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 Sub-Total (a to e)	72* 0.5 0.5 4 6 83				*Note: Heat Cycle Make-up is 3% of BMCR steam flow.
2.	a. Potable Water Requirement b. Backwash of Filter Sub-Total (1 + 2)		2 2 87			
3.	a. Ventilation System Requirement b. AC Plant Requirement c. Fire Water System d. AHP Gland Sealing System e. Backwash Return Sub-Total (1 + 2 + 3)			17 10 - 90 (-) 2 202		C.O.C : 5 CTBD : 372
4.	a. Service Water b. CT Make-up requirement GRAND TOTAL (1 to 4)				25 1884 2111	(Say 21.0 Cusec)



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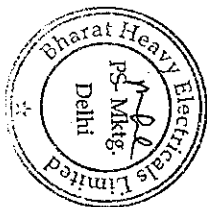


TABLE-IV
ANALYSIS OF COAL
PROXYMATE ANALYSIS

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

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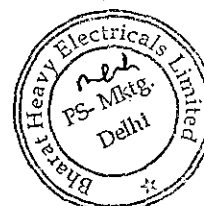


TABLE-V

ASH ANALYSIS
(As Received)

Sl. No.	Characteristic	Result
1.	Silicon dioxide (SiO ₂) plus Aluminium Oxide (Al ₂ O ₃) plus Iron Oxide (Fe ₂ O ₃) present by mass Min.	93.3 – 95.7
2.	Silicon dioxide (SiO ₂), percent by mass Min.	58.4 – 63.0
3.	Total sulphur as sulphur trioxide (SO ₃) percent by mass Max.	0.31 – 0.76
4.	Available alkalis as sodium Oxide (Na ₂ O) 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



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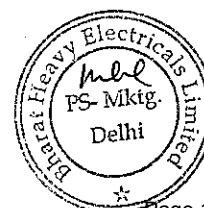
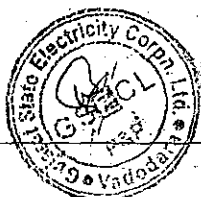


TABLE-VI
FUEL OIL ANALYSIS

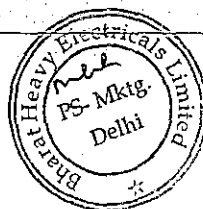
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Sl. No.	Parameters	Unit	LDO	LSHS	HSD
1.0	Density at 15 degC	gm/l	0.8682	0.9708	0.8297
2.0	Water Content	%v/v	0.15	0.10	0.05
3.0	Sediment	%w/w	0.06	0.04	0.02
4.0	Total Sediment	mg/100ml	—	—	0.94
5.0	Redwood Vis. 37.8	Second	30.0	—	—
6.0	Kinematics Vis 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

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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



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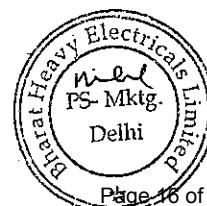
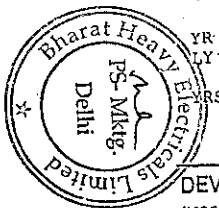


TABLE-VII
CLIMATOLOGICAL TABLE OF BARODA

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

* Occurred More Than Once

42747 .. contd



V.IIA/S-IX : 11

Gujarat State Electricity Corporation Ltd
1x800 MW Supercritical Thermal Power Project

EPC Bid Document
K9213R-EPC-SPC-001

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

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

DEVELOPMENT CONSULTANTS
(K9213R-EPC-SPC-001-Vol-IIA-Sec-9)

V.IIA/S-IX : 12

Gujarat State Electricity Corporation Ltd
1x800 MW Supercritical Thermal Power Project

EPC Bid Document
K9213R-EPC-SPC-001

STATION : Baroda (A) 42748 .. contd

MN	Weather						Wind speed				% Wind Direction								Total Cloud					Low cloud						Visibility					
	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 LY	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
							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		

DEVELOPMENT CONSULTANTS
(K9213R-EPC-SPC-001-Vol-IIA-Sec-9)

V.II/A/S-9 : 13

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.



**1x800 MW WANAKBORI STPP
TECHNICAL SPECIFICATION FOR
EFFLUENT TREATMENT PLANT**

SPECIFICATION No: PE-TS-408-164-A001

VOLUME: II B

SECTION : C

REV. 00

DATE:

SECTION: C

TECHNICAL SPECIFICATIONS



**1x800 MW WANAKBORI STPP
TECHNICAL SPECIFICATION FOR
EFFLUENT TREATMENT PLANT**

SPECIFICATION No: PE-TS-408-164-A001

VOLUME: II B

SECTION : C 1

REV. 00

DATE:

SHEET

SECTION: C 1

SPECIFIC TECHNICAL REQUIREMENT FOR MECHANICAL

	TITLE: 1x800 MW WANAKBORI STPP TECHNICAL SPECIFICATION FOR EFFLUENT TREATMENT PLANT	SPEC NO: PE-TS-408-164-A001	
		VOLUME: II-B	
		SECTION: C1	
		REV NO: 00	DATE:

1.0 GENERAL

The Effluent Treatment Plant with sludge handling system and associated accessories shall conform to the technical specification.

2.0 SCOPE OF SUPPLY

Broad scope of work of this package includes all equipment and accessories and shall be as per the following (please refer flow diagram). Please also refer Electrical (Section-C3) and C&I (Section-C4) for respective scopes.

- Entire Effluent Treatment Plant as per Flow diagram (PE-DG-408-164-A001).
- Two numbers SSF Backwash Waste Water Transfer Pumps with accessories.
- Two numbers Boiler Area Wash Water Transfer Pumps with accessories.
- Two numbers TG Area Wash Water Transfer Pumps with accessories.
- Two numbers Fuel Oil dyke Area Oily Waste Transfer Pumps with accessories.
- Two numbers Power House Area (TG Area) Oily Waste Transfer Pumps with accessories.
- Two numbers Power House Area (SG Area) Oily Waste Transfer Pumps with accessories.
- Two numbers Transformer Yard Area Oily Waste Transfer Pumps with accessories.
- Two numbers Pre Oil Water Separator Collection Pit Transfer Pumps with accessories.
- Two numbers Oil Water Separator Treated Effluent Transfer Pumps with accessories.
- Two numbers CPI Sludge Transfer Pumps with accessories.
- Two numbers CHP Dust Suppression (DS) Pumps with accessories.
- Three numbers Guard Pond Effluent Transfer Pumps with accessories.
- Two numbers Inclined Surface Settler Sludge Transfer Pumps with accessories.
- Three numbers Clear Water Transfer Pumps with accessories.
- Two numbers CPI Sludge Pit Blowers with accessories.
- Two numbers Air blower for Inclined Surface Settler Sludge Pit with accessories.
- One number Oil Water Separator with accessories.
- One number Slope oil storage tank with accessories.
- Two numbers Oil collection Drums with accessories.
- Acid Dosing Systems including Acid dosing tank one number and Acid dosing pumps two numbers with accessories.
- Alkali Dosing Systems including Alkali dosing tank one number and Alkali dosing pumps two numbers with accessories.
- Alum Dosing Systems including Alum Solution Preparation tank two numbers and Alum Solution Transfer cum Recirculation Pumps two numbers with accessories.
- Three Numbers Flash Mixer with accessories.
- Three Number inclined surface settler with accessories.
- Electrical motors for pumps, blower, agitator, etc as per requirement.
- Chain pulley block and electrical hoist with monorail for handling equipment as required.
- Electric hoist with monorail and weighing scale (3 Ton) with accessories in chemical house for chemical handling.
- All tanks and vessels 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.
- Inlet and outlet pipes for each equipment tanks with pipe connections to the respective equipment.
- Necessary pipe and piping inside and outside the Effluent Treatment Plant as specified elsewhere.
- All necessary valves (manual and actuated), actuators and fittings for the installations with the actuators necessary for their remote operation.
- Relay based control panel with accessories.
- All necessary drains, vents and sampling points, with valves, as specified and as required.
- Hangers and supports as per the requirement.
- Exhaust fans (@20 air change/hr) and ventilation system as required in chemical house.
- All pipes, fittings etc required, hand railing, mono rail for hoist and chain pulley block, platforms and ladders shall be in the scope of bidder. All insert plates, embedded plates, rung ladder, nuts and bolts, and matching counter flanges wherever applicable.
- Instrumentation (minimum) as per the enclosed FLOW DIAGRAM (PE-DG-408-164-A001) and as per system requirement with accessories.

	TITLE: 1x800 MW WANAKBORI STPP TECHNICAL SPECIFICATION FOR EFFLUENT TREATMENT PLANT	SPEC NO: PE-TS-408-164-A001	
		VOLUME: II-B	
		SECTION: C1	
		REV NO: 00	DATE:

- 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 PT Plant.
- Start-up and commissioning spares as required.
- All special tools necessary for proper maintenance or adjustment of the equipment packed in permanent box.
- Finish paints for touch up painting of equipments after erection at site in sealed container.
- Initial charge of all lubricants and grease.
- Monitoring gadgets, instruments and equipments required for monitoring (till PG test and plant handover).
- First fill of all chemical including top up chemicals and all required chemicals for pre-commissioning, commissioning, trial run and PG test+3 months of chemical after successful commissioning at rated capacity are in bidder scope.
- Permanent ladder (not rungs) for approaching the sludge pits/sumps, valves for opening/maintenance purpose.
- 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.
- All auxiliary steel structures (U-clamps, nuts, bolts, channels etc.) for fixing the pipe on the pedestal or trestles.
- Arrangement of all instruments/lab facilities at non-returnable basis to carry out trial run/commissioning and PG test is in bidder scope.
- Coating, rapping and protection of buried piping.
- Suitable size and numbers hume pipe for road crossing, refer key plan for details (for 150 NB pipe-6 nos each for 6 meter road crossing, for 50 NB pipe-12 nos each for 6 meter road crossing, for 800 NB pipe-8 nos each for 6 meter road crossing and for 200 NB pipe-8 nos each for 6 meter road crossing).

3.0 SCOPE OF SERVICE

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

- 1) Erection and Commissioning of Effluent Treatment Plant.
- 2) Arrangement of all instruments and lab facilities to carry out trial run/commissioning and PG test.
- 3) All personnel required during pre - commissioning, commissioning and PG Test.
- 4) Performance testing.
- 5) Painting as per enclosed painting schedule. However, any variation in the painting schedule as finally approved by customer shall be taken care by the bidder without any commercial and delivery implication. Color-coding scheme shall be intimated to vendor during detailed engineering.

4.0 TERMINAL POINT

- a. Effluent from respective collection pit to ET plant area, refer Flow diagram for details.
- b. Service air and instrument air: At ET Plant boundary at a distance of 10 meter (it may be at any direction, shall be decided during detailed engineering).
- c. Service water and portable water: At ET Plant boundary at a distance of 10 meter (it may be at any direction, shall be decided during detailed engineering).
- d. Other TP as marked in Key plan.

5.0 EXCLUSIONS

- Service air, Instrument air, upto the terminal point.
- Fire fighting facilities.
- Drinking water and service water.
- Total Civil work is in BHEL Scope of work, however Civil Input drawing shall be provided by bidder. Further Civil design of incline surface settler and oil water separator is in bidder's scope. Civil design for other items except Inclined Surface Settler and Oil Water Separator are in BHEL scope.
- Excavation/back filling for underground piping.
- Acid/alkali resistant lining on RCC.

6.0 QP AND SUBVENDOR APPROVAL

- a) Final quality plans and inspection criteria for all the items shall be subject to approval by BHEL/DCPL/GSECL during detail engineering. Any additional vendors (not listed in the sub-vendor list as enclosed with Technical Specification-PE-TS-408-164-A001)) shall be subject to BHEL/DCPL/GSECL approval during detailed engineering without any price/delivery implication.

	TITLE: 1x800 MW WANAKBORI STPP TECHNICAL SPECIFICATION FOR EFFLUENT TREATMENT PLANT	SPEC NO: PE-TS-408-164-A001	
		VOLUME: II-B	
		SECTION: C1	
		REV NO: 00	DATE:

7.0 DESIGN/CONSTRUCTION

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

The Flow diagram is enclosed herein in this section for bidder's 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 customer approval during detailed engineering.

8.0 DRAWING/DOCUMENTS REQUIREMENT (FOR MECHANICAL/ELECTRICAL/C&I/CIVIL/ETC)

After award of LOI, following drawing/documents shall be submitted by the bidder for BHEL/Customer approval. However, any additional drawing/document if found necessary for completion of the engineering, the same shall be submitted by bidder without any commercial implication.

- Detailed piping and instrument or engineering flow diagram for process and utility, showing all equipments, machinery, piping and instruments. All pipes should be indicated with diameter, pipe class, pipe number, fluid flowing through it as per the Employer's legend to be furnished later.
- Detailed configuration drawings, BOMs, Data Sheets, General arrangements and cross-sectional/assembly drgs, along with the manufacturer's catalogue for all the items/equipment including control & instrumentation supplied by the bidder.
- Detailed installation drawings for all instruments and instrumentation schedule.
- Preparation and finalization of functional write-up and detailed logic diagram, for all control system, electrical wiring and schematic drgs for the development of logic diagrams, GA and layout drgs of control panels, junction boxes, bill of material for panel drgs and terminal, chart for all the panel drgs, inter connection diagram for cabling, cable schedule, earthing layout and cable tray layout drawings..
- Design calculation of process and mechanical design, equipments and systems. The bidder shall show, explain and prove the validity of the basis/procedures and methods used in these calculations.
- Details civil scope/assignment drawing for all civil works.
- Detailed civil structural and construction drawings with calculation of Oil water separator and Inclined surface settler.
- Detailed piping layout drawings, pipe support drawings, complete bill of materials of the piping, valve schedule etc.
- Submission of O&M manual.
- P.G Test procedure shall be submitted by bidder during detail engineering and shall be subject to approval by BHEL/DCPL/GSECL.
- Against customer / BHEL comments bidder has to give replies point wise during detailed engineering after award of contract.

9.0 DRAWING/DOCUMENTS REQUIRED ALONG WITH THE BID (Please refer Electrical and C&I portion also).

- Deviation/clarification, if any, in the BHEL format.
- Compliance certificate.
- Unpriced schedule and unit price schedule.

10.0 ENVIRONMENTAL STIPULATIONS:

The Waste Water Treatment System shall fully comply with all requirements and limits specified in Environmental (Protection) Rules, 1986, along with all latest amendments to it, requirements and stipulations of the Central Pollution Control Board (CPCB), Ministry of Environment and Forests (MOEF); Government of India and Gujarat Pollution Control Board (GPCB) for the project, and any other central or local statutory requirements regarding environmental pollution and its abatement. As regards cases for which no Indian Standard exists, internationally accepted standards like the World Bank's standard, OSHA standards etc. shall be applicable. The Purchaser will decide such applications.

Note-1: Any item/work either supply of equipment or erection material which have not been specifically mentioned in but are necessary to complete the works for trouble free and efficient operation of the plant

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shall be deemed to be included within the scope of this specification. The bidder without any extra charge shall provide the same.

Note-2: All major drawings/documents/Sub vendors shall be approved by BHEL/Customer during detailed engineering. Stage. Successful vendor shall comply with the comment of the customer/BHEL without price & delivery implication.

Note-3: All sump pumps/drives shall be provided with electrically operated monorail hoist for weights weighing 500 kg and above and manually operated chain pulley block for weights weighing 500 kg and less shall be provided by bidders. The monorail required for chain pulley block / electric hoist shall be in bidder scope of supply. Also where the pumps / drives are placed in open area, the supporting structure for monorail shall be provided by the bidder. However, lifting arrangement for equipments located inside chemical house and centrifuge building to be referred.

Note-4: Bidder shall perform the guarantee parameters as per the 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.

Note-5: The Bidder shall arrange all the monitoring gadgets / instruments / equipment required for performing guarantee parameters (returnable after PG test). Site facility as available or as extended by Owner shall only be provided.

Note-6: All equipments shall be dimensioned to provide as undisturbed space, free of pipes or similar obstacles of at least 1000 mm between installed equipment and surrounding enclosures or walkway to ensure proper access for maintenance and operation.

Note-7: 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.

Note-8: The above Note-1 to 7 shall be applicable for Electrical and C&I also.

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RAW WATER ANALYSIS (USING IN PLANT)

TABLE-1

Sl no.	Particulars	Units	Value
1	pH	---	8.42
2	TSS	ppm	15
3	Conductivity	Micro S/cm	440
4	Calcium Hardness	ppm as CaCO ₃	52
5	Magnesium hardness	ppm as CaCO ₃	82
6	Sodium	ppm as CaCO ₃	79
7	Iron in solution	ppm as Fe	Nil
8	Manganese in solution	ppm as CaCO ₃	Nil
9	Total Cations		213
10	Bicarbonate	ppm as CaCO ₃	152
11	Carbonate	ppm as CaCO ₃	2
12	Hydroxide	-----	Nil
13	Sulphate	ppm as CaCO ₃	13
14	Chloride	ppm as CaCO ₃	46.48
15	Nitrate	ppm as NO ₃	Nil
16	Fluoride	ppm as CaCO ₃	Nil
17	Total Anions		213
18	Reactive Silica as SiO ₂	ppm	22
19	Colloidal Silica as SiO ₂	ppm	Nil.

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EFFLUENT WATER QUALITY FOR ETP DESIGN PURPOSE (TABLE-2)

Sl no.	Particulars	Units	Maximum (approx.)
A	REGENERATION WASTE FROM DM PLANT		
1	TDS	ppm	3500
2	TSS	ppm	100
3	PH	--	7.2-8.0
4	Temperature	--	42 Deg C.
5	OIL	PPM	NIL.
B	REGENERATION WASTE FROM CPU		
1	TDS	ppm	2500
2	TSS	ppm	100
3	PH	--	7.2-8.0
4	Temperature	--	42 Deg C.
5	OIL	PPM	NIL.
C	BOILER AND TG AREA WASH WATER		
1	TDS	ppm	220
2	TSS	ppm	500
3	PH	--	8-8.4
4	Temperature	--	42 Deg C.
5	OIL	PPM	20
6	Other parameters shall be similar to Raw Water Analysis.		
D	OILY WASTE FROM POWER HOUSE AREA (TG AND SG).		
1	TDS	ppm	220
2	TSS	ppm	500
3	PH	--	8-8.4
4	Temperature	--	42 Deg C.
5	OIL	PPM	1000
6	Other parameters shall be similar to Raw Water Analysis.		
E	OILY WASTE FROM FUEL OIL DYKE AREA		
1	TDS	ppm	220
2	TSS	ppm	300
3	PH	--	8-8.4
4	Temperature	--	42 Deg C.
5	OIL	PPM	1000
F	OILY WASTE FROM TRANSFORMER YEARD		
1	TDS	ppm	220
2	TSS	ppm	300
3	PH	--	8-8.4
4	Temperature	--	42 Deg C.
5	OIL	PPM	1000
6	Other parameters shall be similar to Raw Water Analysis.		
G	WASTE FROM SIDE STREAM FILTRATION PLANT AND COOLING TOWER BLOW DOWN		
1	TDS	ppm	1100
2	TSS	ppm	1500
3	PH	--	8-8.4
4	Temperature	--	42 Deg C.
5	OIL	PPM	NIL
6	Bicarbonate	ppm as CaCO ₃	152
7	Other parameters shall be similar to Raw Water Analysis multiplied by 5 (Cycle of concentration of Cooling Tower).		

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DATA SHEET-A

1.0	BACKWASH WASTE WATER FROM SIDE STREAM FILTRATION (SSF)	
	Suspended solid at inlet waste water	1500 ppm
1.1	SSF BACKWASH WASTE WATER PIT	
(A)	Number	One (1)
(B)	Description (applicable for each sump)	
I	Type	Underground, Rectangular with flat bottom.
II	Type of fluid to be handled	Backwash waste from Side stream filtration system
III	Effective capacity, m ³	150
IV	Material of Construction	RCC
1.2	SSF BACKWASH WASTE WATER TRANSFER PUMP	
(A)	Number required	Two (2) [1W+1S].
(B)	Description	
I	Type	Vertical Centrifugal type
II	Location	Outdoor
III	Fluid to be handled	Backwash waste from Side stream filtration system
IV	Duty	Intermittent
VI	Rated capacity, each m ³ /hr.	100
VII	Head to be developed at rated capacity, MLC	Shall be decided During Detailed Engineering considering 10% margin to meet the requirements of the system as per Tender Specification. (C should be considered as 100 to calculate frictional loss in pipe as per Hagen Williams Equation)+10 meter static head.
VIII	Pump Speed, RPM	1500
IX	Material of Construction	
	• Casing	2.5 % Ni Cl as per IS 210 FG 260
	• Impeller	Stainless Steel – Gr. 316
	• Shaft	Stainless Steel – Gr. 410
IX	Lubrication type	Self water lubricated.
2.0	BOILER / TG AREA WASH WATER COLLECTION PIT	
2.1	BOILER AREA WASH WATER PIT	
(A)	Number	One (1)
(B)	Description	
I	Type	Underground, Rectangular with flat bottom.
II	Type of fluid to be handled	Boiler Area Wash Water
III	Effective capacity, m ³	5
IV	Material of Construction	RCC
2.2	BOILER AREA WASH WATER TRANSFER PUMPS	
(A)	Number required	Two (2) [1W+1S].
(B)	Description	
I	Type	Vertical Centrifugal type
II	Location	Outdoor
III	Fluid to be handled	Boiler Area Wash Water

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IV	Duty	Continuous
V	Rated capacity, each m ³ /hr ,	5
VI	Tentative Head to be developed at rated capacity, MLC	Shall be decided During Detailed Engineering considering 10% margin to meet the requirements of the system as per Tender Specification. (C should be considered as 100 to calculate frictional loss in pipe as per Hagen Williams Equation)+10 meter static head.
VII	Pump Speed, RPM	1500
VIII	Material of Construction	
	• Casing	2.5 % Ni Cl to IS 210 FG 260
	• Impeller	Stainless Steel – Gr. 316
	• Shaft	Stainless Steel – Gr. 410
IX	Lubrication type	Self water lubricated.
2.3	TG AREA WASH WATER PIT	
(A)	Number	One (1)
(B)	Description	
I	Type	Underground, Rectangular with flat bottom.
II	Type of fluid to be handled	TG Area Wash Water
III	Effective capacity, m ³	5
IV	Material of Construction	RCC
2.4	TG AREA WASH WATER TRANSFER PUMPS	
(A)	Number	Two (2) [1W+1S].
(B)	Description	
I	Type	Vertical Centrifugal type
II	Location	Outdoor
III	Fluid to be handled	TG Area Wash Water
IV	Duty	Continuous
V	Rated capacity, each m ³ /hr ,	5
VI	Tentative Head to be developed at rated capacity, MLC	Shall be decided During Detailed Engineering considering 10% margin to meet the requirements of the system as per Tender Specification. (C should be considered as 100 to calculate frictional loss in pipe as per Hagen Williams Equation)+10 meter static head.
VII	Pump Speed, RPM	1500
VIII	Material of Construction	
	• Casing	2.5 % Ni Cl to IS 210 FG 260
	• Impeller	Stainless Steel – Gr. 316
	• Shaft	Stainless Steel – Gr. 410
IX	Lubrication type	Self water lubricated.
3.0	OIL HANDLING AREA/SERVICE WASTE WATER EFFLUENT	
	• Range of free oil concentration in retention pit-1.	0-1000 mg/ l
	• Total suspended solids.	300 mg/ l (max)
	• Sp. gravity of oil	0.9

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	Kinematic viscosity of oil	2.5 to 15.7 Centistokes @ 38 Deg C
3.1	OILY WASTE FROM FUEL OIL FUEL OIL DYKE AREA	
3.1.1	RETENTION PIT-1	
(A)	Number required	One (1)
(B)	Description (applicable for each sump)	
I	Type	Underground, Rectangular with flat bottom.
II	Type of fluid to be handled	Oily waste from Fuel Oil Dyke area.
III	Effective capacity, m ³	10
IV	Material of Construction	RCC
3.1.2	FUEL OIL DYKE AREA OILY WASTE TRANSFER PUMP	
(A)	Number required	Two (2) [1W+1S].
(B)	Description	
I	Type	Screw type
II	Location	Outdoor
III	Fluid to be handled	Oily Waste form Fuel Oil Storage Area.
IV	Duty	Intermittent
V	Rated capacity each, m ³ /hr,	10
VI	Tentative Head to be developed at rated capacity, MLC	Shall be decided During Detailed Engineering considering 10% margin to meet the requirements of the system as per Tender Specification. (C should be considered as 100 to calculate frictional loss in pipe as per Hagen Williams Equation)+10 meter static head.
VII	Pump Speed, RPM	1500
VIII	Material of Construction	
	Casing	2 % Ni Cl to IS 210 FG 260
	Rotor	SS 316
	Stator	Nitrile /EPDM
	Shaft	SS 316
3.2	OILY WASTE FROM POWER HOUSE AREA (TG AND SG AREA)	
3.2.1	RETENTION PIT FOR OILY WASTE FROM POWER HOUSE AREA (TG AREA)	
(A)	Number required	One (1)
(B)	Description (applicable for each sump)	
I	Type	Underground, Rectangular with flat bottom.
II	Type of fluid to be handled	Service waste from Power House area.
III	Effective capacity, m ³	10
IV	Material of Construction	RCC
3.2.2	POWER HOUSE AREA (TG AREA) OILY WASTE TRANSFER PUMP	
(A)	Number required	Two (2) [1W+1S].
(B)	Description	
I	Type	Screw type
II	Location	Outdoor
III	Fluid to be handled	Service waste from Power House area.
IV	Duty	Intermittent
V	Rated capacity each, m ³ /hr,	5

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VI	Tentative Head to be developed at rated capacity, MLC	Shall be decided During Detailed Engineering considering 10% margin to meet the requirements of the system as per Tender Specification. (C should be considered as 100 to calculate frictional loss in pipe as per Hagen Williams Equation)+10 meter static head.
VII	Pump Speed, RPM	1500
VIII	Material of Construction	
	• Casing	2 % Ni Cl to IS 210 FG 260
	• Rotor	SS 316
	• Stator	Nitrile /EPDM
	• Shaft	SS 316
3.2.3	RETENTION PIT FOR OILY WASTE FROM POWER HOUSE AREA (SG AREA)	
(A)	Number required	One (1)
(B)	Description (applicable for each sump)	
I	Type	Underground, Rectangular with flat bottom.
II	Type of fluid to be handled	Service waste from Power House area.
III	Effective capacity, m ³	10
IV	Material of Construction	RCC
3.2.4	POWER HOUSE AREA (SG AREA) OILY WASTE TRANSFER PUMP	
(A)	Number required	Two (2) [1W+1S].
(B)	Description	
I	Type	Screw type
II	Location	Outdoor
III	Fluid to be handled	Service waste from Power House area.
IV	Duty	Intermittent
V	Rated capacity each, m ³ /hr,	5
VI	Tentative Head to be developed at rated capacity, MLC	Shall be decided During Detailed Engineering considering 10% margin to meet the requirements of the system as per Tender Specification. (C should be considered as 100 to calculate frictional loss in pipe as per Hagen Williams Equation)+10 meter static head.
VII	Pump Speed, RPM	1500
VIII	Material of Construction	
	• Casing	2 % Ni Cl to IS 210 FG 260
	• Rotor	SS 316
	• Stator	Nitrile /EPDM
	• Shaft	SS 316
3.3	OILY WASTE FROM TRANSFORMER YARD AREA	
3.3.1	RETENTION PIT FOR OILY WASTE FROM TRANSFORMER YARD AREA (BURNT OIL COLLECTION PIT)	
(A)	Number required	One (1)
(B)	Description	
I	Type	Underground, Rectangular with flat bottom.
II	Type of fluid to be handled	Oily waste (in case of fire) from Transformer Yard Area.

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III	Effective capacity, m ³	150
IV	Material of Construction	RCC
3.3.2	TRANSFORMER YARD AREA OILY WASTE TRANSFER PUMP	
(A)	Number required	Two (2) [1W+1S].
(B)	Description	
I	Type	Screw type
II	Location	Outdoor
III	Fluid to be handled	Service Waste from Transformer Yard area.
IV	Duty	Intermittent
V	Rated capacity each, m ³ /hr,	10
VI	Tentative Head to be developed at rated capacity, MLC	Shall be decided During Detailed Engineering considering 10% margin to meet the requirements of the system as per Tender Specification. (C should be considered as 100 to calculate frictional loss in pipe as per Hagen Williams Equation)+10 meter static head.
VII	Pump Speed, RPM	1500
VIII	Material of Construction	
	• Casing	2 % Ni Cl to IS 210 FG 260
	• Rotor	SS 316
	• Stator	Nitrile /EPDM
	• Shaft	SS 316
3.4	PRE OIL WATER SEPARATOR COLLECTION PIT	
(A)	Number required	One (1)
(B)	Description	
I	Type	Underground, Rectangular with flat bottom.
II	Type of fluid to be handled	Oily waste from Fuel Oil Storage Area, Power House area & Transformer Yard Area.
III	Effective capacity, m ³	15
IV	Material of Construction	RCC
3.5	PRE OIL WATER SEPARATOR COLLECTION PIT TRANSFER PUMP	
(A)	Number required	Two (2) [1W+1S].
(B)	Description	
I	Type	Screw type
II	Location	Outdoor
III	Fluid to be handled	Oily Waste from Pre Oil Water Separator Collection Pit
IV	Duty	Continuous
V	Rated capacity, Cubic Meter per Hour.	15
VI	Tentative Head to be developed at rated capacity, MLC	Shall be decided During Detailed Engineering considering 10% margin to meet the requirements of the system as per Tender Specification. (C should be considered as 100 to calculate frictional loss in pipe as per Hagen Williams Equation)+10 meter static head.
VII	Pump Speed, RPM	1500

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VIII	Material of Construction	
	Casing	2 % Ni Cl to IS 210 FG 260
	Rotor	SS 316
	Stator	Nitrile /EPDM
	Shaft	SS 316
3.6	OIL WATER SEPARATOR	
(A)	Number required	One (1)
(B)	Type	Plate or Tube with Counter Flow / Cross Flow.
I	Duty	Intermittent
II	Rated output capacity, Cubic Meter per Hour.	15
III	Treated water quality	- Free Oil content not to exceed 10 ppm for free oil concentration 1000 ppm max. in feed waste to the Separator. - Suspended Solids not to exceed 100 ppm for Suspended Solids 300 ppm max. in feed waste to the Separator.
IV	Design Criteria	
a	Angle of inclination of Plates or Tubes	60 degree maximum.
b	Rise Rate	Suitable to provide efficient coalescence and removal of oil from wastewater to maintain oil concentration 10 ppm max. in treated effluent.
V	Material of Construction	
	Body	RCC / Carbon Steel / GRP
	Plates or Tubes	UV inhibited virgin FRP or GRP or PVC.
VI	Oil Skimmer System	Shall be provided.
VII	Sludge Disposal System	By gravity
3.7	SLOP OIL STORAGE TANK	
I	Number required	One (1).
II	Type	Vertical Cylindrical.
III	Type of fluid to be handled	Slop Oil.
IV	Effective capacity,m ³	3
V	Material of Construction	Carbon Steel
VI	Oil collection drum	2 Nos with wheel (MOC: HDPE), each capacity=150 Ltrs.
3.8	RETENTION PIT FOR TREATED WATER FROM OIL WATER SEPARATOR	
(A)	Number required	One (1)
(B)	Description (applicable for each sump)	
I	Type	Underground, Rectangular with flat bottom.
II	Type of fluid to be handled	Treated water from Oil-Water Separator
III	Effective capacity, m ³	15
IV	Material of Construction	RCC
3.9	OIL WATER SEPARATOR TREATED EFFLUENT TRANSFER PUMP	
(A)	Number required	Two (2) [1W+1S].
(B)	Description	
I	Type	Screw type

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II	Location	Outdoor
III	Fluid to be handled	Treated water from Oil-Water Separator
IV	Duty	Intermittent
V	Rated capacity each, m ³ /hr	15
VI	Tentative Head to be developed at rated capacity, MLC	Shall be decided During Detailed Engineering considering 10% margin to meet the requirements of the system as per Tender Specification. (C should be considered as 100 to calculate frictional loss in pipe as per Hagen Williams Equation)+10 meter static head.
VII	Pump Speed, RPM	1500
VIII	Material of Construction	
	• Casing	2 % Ni CI to IS 210 FG 260
	• Rotor	SS 316
	• Stator	Nitrile /EPDM
	• Shaft	SS 316
IX	Lubrication type	Self water lubricated.
3.10	CPI SLUDGE PIT	
A)	Numbers Shall be provided	One (1)
B)	Description	
I	Type	Rectangular with flat bottom.
II	Type of fluid to be handled	Sludge from Oil Water separator
III	Effective capacity of each compartment, m ³ ,(min.)	Not less than 100 % of sludge generated from Oil Water Separator in 8 hours or 10 cum whichever is higher.
IV	Material of Construction	RCC.
V	Type of protection (Internal)	Epoxy painted.
3.11	CPI SLUDGE PIT BLOWER	
A)	Number	Two (2) Number [1W+1S]
B)	Description for each Blower	
I	Location	Outdoor
II	Fluid to be handled	Ambient Air.
III	Service	Sludge mixing
IV	Duty	Continuous.
V	Type of Blower	Rotary, twin lobe
VI	Rated Capacity	Suitable to meet 100% of system requirements
VII	Head to be developed at rated capacity	Head shall be develop at rated capacity and shall be decided during detailed engineering.
VIII	Material of construction	
	• Casing	CI to IS 210 FG 260
	• Lobes	CS to BS 970, EN9 Forged
	• Shaft	CS to BS 970, EN9 Forged
3.12	CPI SLUDGE TRANSFER PUMP	
A)	Number required	Two (2) Number [1W+1S]
B)	Description	
I	Type	Vertical Centrifugal type

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II	Location	Outdoor
III	Fluid to be handled	CPI sludge
IV	Duty	Intermittent
V	Rated capacity, each m ³ /hr.	Suitable to transfer 100 % of sludge generated from Oil Water Separator in 8 hours, within 1 hour or 10 cum/Hr whichever is higher.
VI	Tentative Head to be developed at rated capacity, MLC	Shall be decided During Detailed Engineering considering 10% margin to meet the requirements of the system as per Tender Specification. (C should be considered as 100 to calculate frictional loss in pipe as per Hagen Williams Equation)+10 meter static head.
VII	Pump Speed, RPM	1500
VIII	Material of Construction	
	• Casing	2.5 % Ni Cl as per IS 210 FG 260
	• Impeller	Stainless Steel – Gr. 316
	• Shaft	Stainless Steel – Gr. 410
IX	Lubrication type	Self water lubricated.
4.00.00	GUARD POND	
I	Number	One (1)
II	Number of compartments	Two (2)
III	Type	Underground, Rectangular truncated pyramid type
IV	MOC	Earthen with clay blanket & riprap coating
V	Minimum Effective capacity (Each Compartment), m ³	1500 [The tentative (maximum) water coming from DM N-pit is 50 cum/hr for 2 hours in a day and from CPU it is 50 cum/hr for 6 hours in a day and Boiler and TG area wash water quantity is 5 cum/hr for 2 hours in a day and 96 cum/hr from cooling tower blow down), hence, the total capacity required per day is (50X2+50X6+5X2+5X2+96X24)= 2724 cum/day, each compartment size is selected 1500 cum].
VI	Inlet Arrangement	Inlet chamber with gate
VII	MOC of Inlet Chamber	RCC.
5.00.00	CHP DUST SUPPRESSION (DS) PUMPS	
A)	Number	Two (2) Number [1W+1S]
B)	Description for each Pump	
I	Type of Pump	Vertical Centrifugal type
II	Location	Indoor
III	Fluid to be handled	Water from Guard Pond
IV	Duty	Continuous
V	Rated Capacity each, m ³ /hr,	175
VI	Tentative head to be developed at rated capacity, MLC	35
VII	Range of Operation (%)	10 – 100
VIII	Pump Speed, (RPM)	1500
IX	Material of construction	

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	a) Casing	CI IS-210, FG 260
	b) Impeller	Bronze IS 318, GR. LTB2
	c) Shaft	CS to BS 970, EN 8
X	Lubrication type	Self water lubricated.
6.00.00	GUARD POND EFFLUENT TRANSFER PUMP	
A)	Number	Three (3) Number [2W+1S]
B)	Description for each Pump	
I	Type of Pump	Vertical Centrifugal type
II	Location	Indoor
III	Fluid to be handled	Water from Guard Pond
IV	Duty	Continuous
V	Rated Capacity each, m ³ /hr,	60
VI	Tentative head to be developed at rated capacity, MLC	Shall be decided During Detailed Engineering considering 10% margin to meet the requirements of the system as per Tender Specification. (C should be considered as 100 to calculate frictional loss in pipe as per Hagen Williams Equation)+10 meter static head.
VII	Range of Operation (%)	10 – 100
VIII	Pump Speed, (RPM)	1500
IX	Material of construction	
	a) Casing	CI IS-210, FG 260
	b) Impeller	Bronze IS 318, GR. LTB2
	c) Shaft	CS to BS 970, EN 8
X	Lubrication type	Self water lubricated.
7.00.00	ACID DOSING TANK	
A)	Numbers required	One (1)
B)	Description	
I	Type	Vertical rectangular with flat bottom
II	Location	In the vicinity of Guard Pond Pump House
III	Type of fluid to be handled	Acid Solution
IV	Effective capacity, m ³	2
V	Material of Construction	FRP
VI	Agitator	NA
8.00.00	ACID DOSING PUMP	
A)	Number	Two (2) Number [1W+1S]
B)	Description for each Pump	
I	Type of Pump	Metering pumps, Simplex, mechanically actuated (hydraulically operated) diaphragm type
II	Location	In the vicinity of Guard Pond Pump House
III	Fluid to be handled	Acid Solution.
IV	Rated Capacity each, m ³ /hr	0.5
V	Tentative head to be developed at rated capacity, MLC	Head shall be develop at rated capacity and shall be decided during detailed engineering.
VI	Range of Operation (%)	10 – 100

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VII	Pump Speed, (RPM)	1500
VIII	Material of construction	
	All wetted parts	PP
	Diaphragm	PTFE
9.00.00	ALKALI DOSING TANK	
A)	Numbers required	One (1)
B)	Description	
I	Type	Vertical rectangular with flat bottom
II	Location	In the vicinity of Guard Pond Pump House
III	Type of fluid to be handled	Alkali Solution
IV	Effective capacity, m3	2
V	Material of Construction	FRP
VI	Agitator	
	a) Number	One (1)
	b) MOC	SS 316
10.00.00	ALKALI DOSING PUMP	
A)	Number	Two (2) Number [1W+1S]
B)	Description for each Pump	
I	Type of Pump	Metering pumps, Simplex , mechanically actuated (hydraulically operated) diaphragm type
II	Location	In the vicinity of Guard Pond Pump House
III	Fluid to be handled	Alkali Solution.
IV	Rated Capacity each, m3/hr	0.5
V	Tentative head to be developed at rated capacity, MLC	Head shall be develop at rated capacity and shall be decided during detailed engineering.
VI	Range of Operation (%)	10 – 100
VII	Pump Speed, (RPM)	1500
VIII	Material of construction	
	All wetted parts	SS-316.
	Diaphragm	PTFE
11.00.00	FLASH MIXER	
A)	Numbers Shall be provided	Three (3W+0S)
B)	Description for Unit	
I	Type	Flash mixer provided with baffle wall inside.
II	Effective Capacity , m ³ /hr	60 (each)
III	Design residence time	60 sec
IV	Material of Construction	RCC
V	Agitator	MS Epoxy painted, Motor driven
12.00.00	FLOCCULATION TANK	
A)	Numbers Shall be provided	Three (3W+0S)
B)	Description for Unit	
I	Type	RCC tank provided with baffle wall inside.
II	Effective Capacity , m ³ /hr	60 (each)
III	Design residence time	30 min

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IV	Material of Construction	RCC
V	Agitator	MS Epoxy painted, Motor driven
13.00.00	INCLINED SURFACE SETTLER	
A)	Number Shall be provided	Three (3W+0S)
B)	Description for each Settler	
I	Type	Plate Settlers/Tube Settler
II	Output Capacity for each at rated condition, m ³ /hr	60 each
III	Suspended solids in treated water at rated condition, ppm	Not to exceed 100 ppm with Inlet suspended load of 1000 ppm (maximum).
IV	Surface flow rate	Not exceed to 1.2 m ² /m ³ /hr (based on Projected Effective Surface Area)
V	Material of Construction	
	a) Body	RCC
	b) Plate/tube	FRP
VI	Sludge disposal arrangement	
	Intermittent	Main sludge disposal line shall consist of manual adjustable timer operated blow-off valve with manual over riding facilities.
	• Continuous	By gravity
14.00.00	INCLINED SURFACE SETTLER SLUDGE SUMP	
A)	Numbers Shall be provided	One (1) number with two compartments
B)	Description	
I	Type	Rectangular with two compartments and flat bottom.
II	Type of fluid to be handled	Sludge from Inclined Surface Settler and sludge from CPI.
III	Effective capacity of each compartment m ³ /hr	Suitable to hold sludge generated from three (3) Inclined Surface Settlers and CPI Sludge Pit at rated condition for one (1) hour.
IV	Minimum Free Board, in mm.	500
V	Material of Construction	RCC.
VI	Type of Protection	
	Internal	Epoxy painted as per painting specification.
	External	Not applicable
15.00.00	INCLINED SURFACE SETTLER SLUDGE TRANSFER PUMPS	
A)	Number required	Two (2) Number [1W+1S]
B)	Description	
I	Type	Vertical Centrifugal type
II	Location	Outdoor
III	Fluid to be handled	Sludge generated from Inclined surface Settler and from CPI sludge pit.
IV	Duty	Intermittent

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V	Rated capacity, each m ³ /hr.	Suitable to transfer 100 % of sludge generated from two (2) numbers Inclined surface Settlers at rated condition as well as CPI sludge from CPI sludge pit within 1 hour or 10 cum/hr whichever is higher.
VI	Tentative Head to be developed at rated capacity, MLC	Shall be decided During Detailed Engineering considering 10% margin to meet the requirements of the system as per Tender Specification. (C should be considered as 100 to calculate frictional loss in pipe as per Hagen Williams Equation)+10 meter static head.
VII	Pump Speed, RPM	1500
VIII	Material of Construction	
	Casing	2.5 % Ni Cl as per IS 210 FG 260
	Impeller	Stainless Steel – Gr. 316
	Shaft	Stainless Steel – Gr. 410
IX	Lubrication type	Self water lubricated.
16.00.00	ALUM SOLUTION PREPARATION TANKS	
A)	Numbers required	Two (2) Number [1W+1S]
B)	Description (applicable for each Tank)	
I	Type	Vertical rectangular with flat bottom
II	Type of fluid to be handled	10 % w/w Alum Solution.
III	Effective capacity of each tank, m ³ /hr	Adequate to hold the quantity required for twelve (12) hours of operation for treatment of overall waste plus 25% margin
IV	Free Board, mm	300
V	Design Pressure, Kg/sq. cm (g)	Atmospheric
VI	Design Temperature, °C	60
VII	Material of Construction	RCC.
VIII	Protection	
	Internal	Acid Proof Tile Lining
	External	Not applicable
IX	Agitator along with drive motor and all other accessories	
	Number	One (1) per Tank
	Material of Construction	SS 316
X	Dissolving Basket	
	Number	One (1) per Tank
	Material of Construction	SS 316
17.00.00	ALUM SOLUTION TRANSFER CUM RECIRCULATION PUMPS	
A)	Number	Two (2) Number [1W+1S]
B)	Description for each Pump	
I	Type of Pump	Positive displacement and hydraulic diaphragm type with stroke adjustment.
II	Location	Indoor.
III	Fluid to be handled	10 % w/w Alum Solution.
IV	Service	To dose Alum solution to the Inclined surface Settlers

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V	Duty	Continuous and suitable for parallel operation
VI	Suction Condition	Flooded
VII	Rated Capacity, m ³ /hr	100 % requirement at full load condition of the plant
VIII	Tentative head to be developed at rated capacity, MLC	Head shall be develop at rated capacity and shall be decided during detailed engineering.
IX	Design Temperature, °C	60
X	Range of Operation (%)	0 – 100
XI	Pump Speed, (RPM)	1500
XII	Material of construction	
	All wetted parts	SS-316.
	Diaphragm	PTFE
XIII	Type of drive	Electrical Motor
18.00.00	AIR BLOWER FOR INCLINED SURFACE SETTLER SLUDGE PIT	
A)	Number	Two (2) Number [1W+1S]
B)	Description for each Blower	
I	Location	Outdoor
II	Fluid to be handled	Ambient Air.
III	Service	Sludge mixing
IV	Duty	Intermittent
V	Type of Blower	Rotary, twin lobe
VI	Rated Capacity	Suitable to meet 100% of system requirements
VII	Head to be developed at rated capacity	Head shall be develop at rated capacity and shall be decided during detailed engineering.
VIII	Material of construction	
	Casing	CI to IS 210 FG 260
	Lobes	CS to BS 970, EN9 Forged
	Shaft	CS to BS 970, EN9 Forged
19.00.00	CLEAR WATER RESERVOIR	
I	Number	One (1)
II	Number of compartment	Two (2)
III	Description	
IV	Type	Underground, Rectangular with flat bottom.
V	Type of fluid to be handled	Treated water from Oil-Water Separator
VII	Effective capacity, m ³ (each compartment)	240
VIII	Material of Construction	RCC
20.00.00	CLEAR WATER TRANSFER PUMP	
I	Number required	Three (3) Number [2W+1S]
II	Description	
III	Type	Vertical centrifugal.
IV	Location	Outdoor
V	Fluid to be handled	Treated water from Inclined Surface Settler.
VII	Duty	Intermittent
VIII	Rated capacity each, m ³ /hr	60

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IX	Tentative Head to be developed at rated capacity, MLC	Shall be decided During Detailed Engineering considering 10% margin to meet the requirements of the system as per Tender Specification. (C should be considered as 100 to calculate frictional loss in pipe as per Hagen Williams Equation)+10 meter static head.
X	Pump Speed, RPM	1500
XI	Range of operation	10-100%.
XII	Material of Construction	
	Casing	2 % Ni Cl to IS 210 FG 260
	Impeller	Bronze as per IS 318, GR LTB2.
	Shaft	CS to BS 970, EN 8
XIII	Lubrication type	Self water lubricated.
21.00.00	CHEMICAL HOUSE	
i.	Number	One (1).
ii.	Type	Single storied building of civil construction.
iii.	Building dimensions	DDE
iv.	Purpose	Storage and handling of chemical required for Effluent Treatment plant and control of effluent treatment plant including LCP location.
22.00.00	VALVES	Material of Construction
i.	Gate (All gate valves shall have flanged end connections, it shall be outside screw rising stem type with hand wheel). [Design Std-API 602 and Testing Std-API 598 for <50 NB size and Design Std-API 600 and Testing Std-API 598 for >=50 NB size].	Rating: PN 10 (min). Body/Bonnet – Cast Iron. Stem – stainless steel AISI 410/ 13% chrome steel. Disc – Cast iron. Seat & seat rings – 13% Chromium steel. Hand wheel- Cast iron.
ii.	NRV (All NRV shall have flanged end connection. For bore greater than 50 mm valves shall be swing check type. For bore smaller than or equal to 50 mm it shall be piston type). [Design Std-BS 5352 and Testing Std-BS 6755 for <50 NB size and Design BS 1868 and Testing Std-BS 6755 for >=50 NB size].	Swing Check type Body – Cast Iron Disc/door – Cast Iron Hinged pin – SS 316 Piston type Body – Cast Iron Hinge pin – SS316 Piston – SS Disc- Cast Iron
iii	Ball valve	Type :Full bore Rating: PN 10 (min). Body: cast Iron/carbon steel Ball: stainless steel Seat ring: PTFE Stem: Stainless steel Seat: Nitrile rubber, PTFE
iv	Globe valve [Design Std-BS 5352 and Testing Std-BS 6755 for <50 NB size and Design BS 1873 and Testing Std-BS 6755 for >=50 NB size].	Type: Double flanged. Rating: PN 10 (min). Body: Cast iron:IS 210 Gr FG260 Stem: stainless steel.

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v	Plug Valve	Type :Full bore Rating: PN 10 (min). Body: cast Iron/carbon steel Plug: Stainless steel Seat: Nitrile rubber, PTFE
vi	Butter fly valve (other than indicated above in this data sheet)	Butterfly valves shall be of Lugged wafer type of low leakage rate confirming to AWWA-C-504 class 150 (min.) or BS:5155 PN 10 (min.) Body: cast Iron IS:210 Gr. FG 260 Disc: SS 316. Shaft:ASTM.A296 Gr. CF8M Seat rings: Nitrilerubber, EPDM,Hypalon All the butterfly valves shall be provided with Hand wheel or lever as per the requirements. All the butterfly valves shall be provided with an indicator to show the position of the disc. Flanges shall conform to ANSI B 16.5 Cl.150 (min).
vii	Diaphragm valve	The Diaphragm shall conform to following requirement 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
viii	Needle valve	Rating: PN 10 (min). Body– Cast Iron. Stem – stainless steel AISI 410/ 13% chrome steel. Handel- Cast iron.
ix	Valves for chemical application	All parts of valve shall be of SS 316.
x	ISOLATION GATE (SLUICE GATE)	GATE FRAME & SHUTTER: MILD STEEL IS:2062 Gr 'B'. BOTTOM RUBBER SEAL: EPDM RUBBER STEM/SPINDLE: MILD STEEL IS:2062 Gr 'A'. HEADSTOCK: CAST IRON IS :210 FG 200 STEM BLOCK/THRUST NUT: CF8 ASSEMBLY FASTNERS: ASTM A276 TYPE 304 YOKE: MILD STEEL IS:2062 Gr 'A'
23.00.00	PIPE	Refer FLOW DIAGRAM.
24.00.00	SAFETY EQUIPMENTS	Four sets of safety equipment comprising PVC protection suits with hoods, rubber boots, face visors and thick PVC gauntlets shall also be provided. A personnel water drench shower and eye bath shall be provided.



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TECHNICAL SPECIFICATION FOR
EFFLUENT TREATMENT PLANT**

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CUSTOMER SPECIFICATIONS



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TECHNICAL SPECIFICATION FOR
EFFLUENT TREATMENT PLANT**

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**CUSTOMER SPECIFICATIONS
TECHNICAL REQUIREMENT**

VOLUME : IIK/3

SECTION-III

**TECHNICAL SPECIFICATION
FOR
WASTE WATER TREATMENT SYSTEM**

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**SECTION-III
TECHNICAL SPECIFICATIONS
FOR
WASTE WATER TREATMENT SYSTEM**

1.00.00 GENERAL REQUIREMENT

The Bidder shall design and develop the Waste Water Treatment System thereof, adopting the philosophy of 100% recycling of treated effluent for a "Zero Discharge" concept for management. Each identified effluent stream shall be subjected to required treatment, and then they will be equalized in a Guard pond. The Guard pond shall be divided in two compartments each of same capacity. The treatment facilities will be such that quality of outlet from each treatment facility as well as that at the Guard pond outlet must individually meet applicable standards for discharge of liquid effluents to surface water.

Final treated effluent will meet the stipulations laid down in the "General Standards for Discharge of Environmental Pollutants Part-A : Effluents" as well as those specified in "Standards for Discharge of Liquid Effluents from Thermal Power Plants" as provided in the Environment (Protection) Rules, 1986, Schedule-VI (vide GOI's Extra Ordinary Gazette Notification dated 31.12.1993 as well as in Schedule – I of the said Rules.

2.00.00 ENVIRONMENTAL STIPULATIONS

2.01.00 The Effluent Treatment System shall fully comply with all requirements and limits specified in Environmental (Protection) Rules, 1986, along with all latest amendments to it, requirements and stipulations of the Central Pollution Control Board (CPCB), Ministry of Environment and Forests (MOEF); Government of India and Gujrat Pollution Control Board (GPCB) for the project, and any other central or local statutory requirements regarding environmental pollution and its abatement. As regards cases for which no Indian Standard exists, internationally accepted standards like the World Bank's standard, OSHA standards etc. shall be applicable. The Consultants and the Owner will decide such applications.

The basic requirements for this project are indicated below for reference of the Bidder. However, it shall be the Bidder's responsibility to ensure full compliance with the latest amendments of all applicable regulations.

Relevant conditions of the permits already obtained / to be obtained for the project shall be passed on to the Bidder. Bidder shall ensure full compliance with the same. The Bidder shall be responsible for obtaining all other necessary consents, licenses and permissions, which are related to design, construction, installation and operation of the plant. These shall be obtained in appropriate time to ensure that the construction and commissioning program can be achieved.

3.00.00 **NOISE EMISSIONS**

3.01.00 An integrated approach shall be taken by the Bidder to control noise emission which shall include but not be limited to:

- a) Design and layout of building to minimize transmission of noise, segregation of particular items of plant and to avoid reverberant areas.
- b) Specification of permissible noise levels for bought out items.
- c) Choice of materials for civil construction
- d) Acoustic design of building
- e) Use of lagging with attenuation properties on plant components.

3.02.00 **Noise Levels Local to Plant**

Following criteria shall apply during all continuous operating conditions of the plant.

3.02.01 **Maximum Noise Level**

This shall remain within the requirements and limits as stated in Clause no. 2.01.00 above as well as those stated below :

Noise Control (requirements in addition to the stipulations elsewhere of this Specification)

- a) Maximum permissible surface noise level measured at a distance of one (1) metre from any point of the surface of the item and 1.5 metre above floor level under any operating condition for :
 - i) Air Compressors and Blowers 95 dB(A)
 - ii) Safety valves and their discharge piping 105 dB(A) (Also within 75 dB(A) at 400 M distance)
 - iii) All other equipment, valves, piping, ducting and vessels 85 dB(A)
- b) Maximum permissible noise level in
 - i) Control rooms
 - back-ground noise level 50 dB(A)
 - speech interference level 40 dB(A)

- ii) Other control areas, where person-to-person or telephonic conversation is required :
 - back-ground noise level 65 dB(A)
 - speech interference level 55 dB(A)
- iii) other rooms/building where various plant and equipment are housed 85 dB(A)

Note: 1.

Noise level shall be measured with a calibrated integrating sound level meter meeting the requirement of IEC-651 or BS-5969 or IS-9779.

3.02.02 Noise Control

Where the requirements stated above are not met within the basic design of the plant they shall be achieved by the supply under the contract of suitable means of noise control, which shall conform to the following requirements :

- a) The noise control system shall, as far as possible, be designed to form an integral part of the plant & equipment.
- b) The abatement system shall, wherever practicable, be applied to the source of excessive noise rather than to the entire item or component.
- c) If above means are not adequate and enclosures are used for noise abatement, close fitting enclosures, which do not require or allow personnel access are preferred. The maximum surface noise level of these enclosures shall not exceed 85 dB(A).
- d) Noise abatement measures shall be such as to ensure that safety, operation and maintenance of the treated item or component are not impeded.

4.00.00 **SYSTEM DESCRIPTION & GENERAL INFORMATION**

The wastewater streams from different sources of 1 x 8000 MW Unit Power Station will be collected, treated and then reused to the maximum extent possible within the Plant. Various waste waters, which are to be handled and treated for reuse otherwise disposal, are described herein:

P&ID for Effluent Treatment System is enclosed.

4.01.00 **DM Regeneration Waste**

DM Plant Regeneration Waste will be generated due to periodic regeneration of resin-beds by acid or alkali. It will contain high amount of dissolved solids and also will be acidic or alkaline based on the nature of requirements for the regeneration.

The regeneration waste comprising of acid, alkali from the DM plant is led to the Neutralization Pit through drain channels. The pH of neutralized waste is maintained in the range of 7.2-8.0.

Backwash waste from DMFs as well as ACFs shall be collected in a local pit (Backwash Waste Collection Pit as addressed under Dwg No. K9213R-DWG-M-WTP-001A, Rev.-1) and finally transferred into the inlet of Existing Clarifier.

Once the pH level in the waste is achieved within desirable range the same is pumped to the Guard pond by means of Neutralized Waste Disposal Pumps. As the treatment of DM Plant regeneration waste is carried out in DM Plant itself, no further treatment scheme for control of pH has been envisaged.

4.02.00 **Cooling Tower Blow Down**

Cooling Tower Blow Down is done to maintain the level of dissolved solids in the Circulating Cooling Water. This effluent will contain dissolved solids and chemicals/biocides used for prevention of scale formation/corrosion/ bio fouling. Major part of CT blow down shall be used in AHP along with some part being used for CHP DE/DS and the balance part shall be led to Guard Pond.

4.03.00 **Backwash Waste Water from Side Stream Filtration**

Backwash waste from Side Stream Filters will be collected in a pit and then transferred to inlet of Inclined Surface Settler by means of Backwash Water Transfer Pumps.

Suspended solids at inlet : 1500 ppm (max.)

The System viz. Backwash Waste Water Pit, Backwash Waste Water Transfer Pumps etc. shall be located outdoor.

4.04.00 **Quenched Boiler Blowdown Recycling system**

The Boiler Blow Down shall be collected in Boiler Blow Down Drain Pit at around 60°C temperature. The water from Drain Pit shall be pumped to Guard pond for further reuse.

The System viz. Hot Boiler Blow Down Drain Pit, Boiler Blow Down Transfer Pumps etc. shall be located outdoor.

Suspended solids at inlet : 20 ppm (max.)

pH : 6.5-8.5

4.05.00 **Oil Handling Area Effluent and Service Oily Waste**

The oily water run off during rains and regular washing/cleaning, leakage and draining from Fuel Oil Unloading Area shall be treated in Oily Waste Treatment System. An underground Retention Pit shall be provided to collect run off water. Oily waste from the above Retention Pit shall be directed to a Pre Oil Water Separator Collection Pit, which also receives service oily waste effluent from Power House area and oily waste from Transformer Yard area.

From the Pre Oil Water Separator Collection Pit the oil contaminated effluent shall be pumped to plate or tube type Oil Water Separator for removal of oil and suspended solids. Separated oil shall be collected in a Slop Oil Storage Tank. The treated water from OWS may be discharged in another collection pit from where treated water shall be pumped finally to CHP dust suppression.

Sludge generated from Oil Water Separator shall be directed to Sludge Collection Pit for Inclined Surface Settler. From Sludge Collection Pit for Inclined Surface Settler the sludge shall be fed to a Sludge Drying bed (with two compartments) located in the vicinity of Guard Pond. Each compartment of Sludge Drying Bed shall be sized to hold sludge generated from Oil Water Separator as well as Inclined Surface Settlers in 10 days.

Major amount of oily effluent from the Transformer Yard Area will be generated only during periods of rainfall. The rainwater entering each of transformer pits containing small amount of oil and TSS will be led to the Pre Oil Water Separator Collection Pit as addressed above.

Powerhouse area effluent is generated from floor washings, leakages from bearing cooling systems, leakage from pumps, hydraulic couplings, oil leakage from oil burners etc. This effluent basically contains suspended solids and some oil and grease. An underground Retention Pit shall be provided to collect service oily waste from power House area. From Retention Pit, the waste shall be transferred by Pumps to Pre Oil Water Separator Collection Pit as addressed above.

The Treatment System shall be designed based on the parameters as follows:

Oil concentration at inlet	:	1000 mg/lmax.
Suspended solids at inlet	:	300 mg/l max.
Oil concentration in treated water	:	10 mg/l max.
Suspended solids in treated water	:	100 mg/l max.

The System viz. Oily Waste Retention Pit, Oily Waste Feed Pumps, Oil Water Separator, Slop Oil Storage Tank etc. shall be located outdoor.

4.06.00 **Coal Pile Rainfall Runoff**

Rainfall run-off from the coal piles shall be collected by a drainage system around the coal pile and led by gravity to a Coal Particle Settling Basin.

The Coal Particle Settling Basin will have two chambers, one operating and one standby. When one chamber will be full, the second chamber will be put into service.

Coagulant aid/ polymer dosing facility shall be provided at the inlet to the Settling Basin, if required.

The settling basin should be sized to treat maximum rainfall water run off from the Coal Pile .For this purpose, the rain intensity for the half an hour peak rainfall shall be considered. The remaining portion of the storm runoff will be bypassed to the nearby storm water drain.

The decanted water shall be collected in a Decanted Water Sump and thereafter pumped for discharge to the Rain Water Harvesting Pond.

The Treatment System shall be designed based on the parameters as follows:

Suspended solids at inlet	:	1000 mg/l max.
Specific gravity of coal particles	:	1.2
Particle density	:	750 kg/m ³
Particle size to be settled	:	50 microns
Maximum rainfall considered	:	45 mm/hr

The System viz. Coal Particle Settling Basin, Decanted Water Sump, Decanted Water Transfer Pumps etc. shall be located outdoor and Coagulant Aid/ Polymer Dosing Facility shall be located inside Chemical House for CHP Waste Treatment.

4.07.00 **Condensate Polishing Unit Effluent**

Condensate Polishing Plant (condensate polishing plant is located at Boiler area / Power House ground floor) will cause regeneration effluent also. This effluent shall be collected in separate neutralization pits to be constructed in the Boiler / Power House area. This effluent will be generated once in every 7 days or so. Neutralized effluent from the above area shall be transferred to the Guard pond.

4.08.00 **Guard pond Waste Treatment & Recycling System**

All liquid effluent after required treatment will be led to a Guard pond, which acts as an equalization basin. The pond will have at least 8 hour's detention period calculated based on average hourly flow of total effluents.

From Guard pond wastewater will be pumped by means of Three (3) nos. Guard pond Effluent Transfer Pump to three (3) nos. Flash Mixers. From Flash Mixers, water would be directed to three (3) nos. Flocculation Tanks. From Flocculation Tanks water will then flow to three (3) nos. Inclined Surface Settlers. Alum solution will be added to water.

Normally, all three (3) Flash Mixers, three (3) Flocculation Tanks and three (3) Inclined Surface Settlers will operate in under-load condition. However, in case any one hook-up, consisting of Flash Mixer, Flocculation Tank or Inclined Surface Settler is taken out for maintenance, the other two streams with 20 % overload will be able to cater for the total water requirement.

The treated water from Inclined Surface Settlers shall be stored in a Clear Water Reservoir. From the reservoir water shall be distributed to Ash handling plant.

Sludge generated from Oil Water Separator shall be directed to Sludge Collection Pit for Inclined Surface Settler. From Sludge Collection Pit for Inclined Surface Settler the sludge shall be fed to a Sludge Drying bed (with two compartments) located in the vicinity of Guard Pond.

Each compartment of Sludge Drying Bed shall be sized to hold sludge generated from Oil Water Separator as well as Inclined Surface Settlers in 10 days.

Two (2) nos. Air Blowers shall be provided for the sludge sump for proper agitation.

All chemicals required for the entire plant will be stored in the of a Chemical House.

5.00.00 **OPERATION AND CONTROL PHILOSOPHY**

The control concept for Effluent Treatment System shall be such that the operation of the total Treatment System can be monitored and controlled from Local Control Panels (relay based hardware) as described hereinafter. The panels shall be used for mounting instruments, annunciators etc.

The Control Panels to be provided are as follows:

One (1) no. LCP is to be provided within CMB Wastewater Pump House adjacent to Guard pond for control and monitoring of following Equipment & Accessories:

- Guard pond - Guard pond Effluent Transfer pumps – Alum Solution Preparation Tanks- Alum Solution Transfer Cum Recirculation Pump.
- Clear Water Reservoir - Clear Water Transfer Pumps

One (1) no. LCP is to be provided near Cooling Tower for control and monitoring of following Equipment & Accessories:

- Backwash Waste Water Transfer Pump Sump - Backwash Waste Water Transfer Pumps (System envisaged with reference to Side Stream Filtration backwash waste)
- Backwash Waste Water Transfer Pump Sump - Backwash Waste Water Transfer Pumps (System envisaged with reference to backwash waste of Dual Media Filters/ACFs)

One (1) no. LCP is to be provided near Boiler area for control and monitoring of following Equipment & Accessories:

- Boiler Blow Down Transfer Pump Sump - Boiler Blow Down Transfer Pumps (System envisaged for recycling of quenched boiler blow down)
- Power House Area Service Oily Waste Transfer Pump Sump- Power House Area Service Oily Waste Transfer Pump. (System envisaged with reference to service oily waste from Power House Area)

One (1) no. LCP is to be provided near Fuel Oil area for control and monitoring of following Equipment & Accessories:

- Collection Pit for Oily waste from Fuel Oil Storage Area-Oily waste from Fuel Oil Storage Area Transfer Pump-Pre Oil Water Separator Collection Sump- Pre Oil Water Separator Collection Sump Transfer Pumps-Slop Oil Tank - Oil Water Separator Treated Effluent Transfer Pump Sump- Oil Water Separator Treated Effluent Transfer Pumps - CPI Sludge Transfer Pump Sump - CPI Sludge Transfer Pumps-Air Blowers for CPI Sludge Pit (System envisaged for treatment of oily waste).

One (1) no. LCP is to be provided near Coal Handling Area (Within Chemical House for Coal Pile Rainfall Run-off-Single storied) for control and monitoring of following Equipment & Accessories :

- Decanted Water Transfer Pump Sump- Decanted Water Transfer Pump

ON/OFF/TRIP status of all pumps, blowers and drive motors under scope of supply, ammeters for drive motors wherever required shall be displayed in Control Panels.

All drive motors shall be provided with arrangement of local starting and stopping. Local starting shall be possible through remote/local selector switch in control panel or in MCC. Tripping of drive motors locally shall be permissible irrespective of position of remote/local selector switch.

Annunciation panel showing tripping of different motors shall be located in each of the Control Panels.

The Tenderer shall furnish all instruments, interlocks, annunciations, etc. required for the type of control envisaged and in accordance with the specification.

The control philosophy for the different treatment systems shall be relay logic based and as follows:

- Backwash Waste Water From Side Stream Filtration System

Backwash wastewater pit is provided with two nos. Level Switches .One level switch is envisaged to sense the low set point and the other level switch is envisaged to sense high set point. The Backwash Waste Water Transfer Pump will be started when the sump level reaches high level and trips automatically when the level reaches low level. The Alarms (High & Low) shall be annunciated in local control panel.

The pit is provided with two nos. Backwash Waste Water Transfer pumps with 1 working 1 standby philosophy for transferring waste from the above sump to inlet of Inclined Surface Settlers. Any of the pump shall be selected for standby duty, which would start remote manually in the event of failure of running pump.

- **Backwash Waste Water From Filters**

Backwash wastewater pit is provided with two nos. Level Switches .One level switch is envisaged to sense the low set point and the other level switch is envisaged to sense high set point. The Backwash Waste Water Transfer Pump will be started when the sump level reaches high level and trips automatically when the level reaches low level. The Alarms (High & Low) shall be annunciated in local control panel.

The pit is provided with two nos. Backwash Waste Water Transfer pumps with 1 working 1 standby philosophy for transferring waste from the above sump to inlet of existing Clarifiers. Any of the pump shall be selected for standby duty, which would start remote manually in the event of failure of running pump.

- **Boiler Blow Down Water Recycle System**

Boiler Blow Down Drain Pit is provided with two nos. Level Switches .One level switch shall sense the low set point and the other level switch shall sense high set point. The Boiler Blow Down Transfer Pumps will be started when the sump level reaches high level and trips automatically when the level reaches low level.

The Alarms (High & Low) shall be annunciated in local control panel.

The pit is provided with three nos. Boiler Blow Down Transfer Pumps with 2 working 1 standby philosophy for transferring water from the above sump to Guard Pond. Any of the pump shall be selected for standby duty, which would start remote manually in the event of failure of running pump.

- **Oil Handling Area/Service Waste Water Effluent**

Retention Pit for Oily Waste from Fuel Oil Storage Area is provided with two nos. Level Switches .One level switch is envisaged to sense the low set point and the other level switch is envisaged to sense high set point. The Fuel Oil Storage Area Oily Waste Transfer pump will be started when the sump level reaches high level and trips automatically when the level reaches low level. The Alarms (High & Low) shall be annunciated in local control panel.

The Retention Pit for Oily Waste from Fuel Oil Storage Area should be sized to treat maximum rainfall water run off from the Fuel Oil Area .For this purpose, the rain intensity for the one (1) hour peak rainfall shall be considered. After initial period of excessive rainfall the remaining portion of the storm runoff will be bypassed to the nearby storm water drain.

The pit is provided with two (2) nos. Fuel Oil Storage Area Oily Waste Transfer pump with 1 working and 1 standby philosophy for transferring water from the above sump to Pre Oil Water Separator Collection Sump. Any of the pumps shall be selected for standby duty, which would start remote manually in the event of failure of running pump.

Retention Pit for Service Oily Waste from Power House Area is provided with two nos. Level Switches .One level switch is envisaged to sense the low set point and the other level switch is envisaged to sense high set point. The Power House Area Service Oily Waste Transfer Pump will be started when the sump level reaches high level and trips automatically when the level reaches low level. The Alarms (High & Low) shall be annunciated in local control panel.

The pit is provided with two nos. Power House Area Service Oily Waste Transfer Pump with 1 working 1 standby philosophy for transferring oily water from the above sump to Pre Oil Water Separator Collection Sump. Any of the pump shall be selected for standby duty, which would start remote manually in the event of failure of running pump.

Pre Oil Water Separator Collection Sump is provided with two nos. Level Switches .One level switch is envisaged to sense the low set point and the other level switch is envisaged to sense high set point. The Pre Oil Water Separator Collection Sump Transfer Pumps will be started when the sump level reaches high level and trips automatically when the level reaches low level. The Alarms (High & Low) shall be annunciated in local control panel.

The pit is provided with three nos. Common Oily Waste Transfer Pumps with 1 working 1 standby philosophy for transferring oily water from the above sump to CPI type Oil Water Separator (OWS). Any of the pumps shall be selected for standby duty, which would start remote manually in the event of failure of running pump.

The slop oil tank is provided with a level switch with high-level alarm in the panel. At high level alarm the operator needs to take necessary action to empty the slop oil tank.

Retention Pit for Treated Water from Oil Water Separator is provided with two nos. Level Switches. One level switch is envisaged to sense the low set point and the other level switch is envisaged to sense high set point. The Oil Water Separator Treated Effluent Transfer Pumps will be started when the sump level reaches high level and trips automatically when the level reaches low level. The Alarms (High & Low) shall be annunciated in local control panel.

The pit is provided with two nos. Oil Water Separator Treated Effluent Transfer Pumps with 1 working 1 standby philosophy for transferring oily water from the above sump to CHP D/S area. Any of the pumps shall be selected for standby duty, which would start remote manually in the event of failure of running pump.

OWS Sludge Pit is provided with two nos. Level Switches. One level switch is envisaged to sense the low set point and the other level switch is envisaged to sense high set point. The CPI Sludge Transfer Pumps will be started when the pit level reaches high level & trips automatically when the level reaches low level. The Alarms (High & Low) shall be annunciated in local control panel.

The pit is provided with two nos. CPI Sludge Transfer Pumps with 1 working 1 standby philosophy for transferring CPI sludge from the above sump to a suitable point from where sludge will be collected manually and used for land filling. Any of the pumps shall be selected for standby duty, which would start remote manually in the event of failure of running pump.

- Coal Pile Rainfall Run-off

The overflow from the settling basin is taken to Decanted Water Sump provided with two nos. Decanted Water Transfer Pumps of submersible type. These pumps upon selection shall start and stop automatically through the level switch. The pumps are suitable to transfer decanted water to Rain Water Harvesting Pond within a shift.

The pump will start at High level in the sump and the preset low level in the sump will trip the pumps. The Alarms (High & Low) shall be annunciated in local control panel.

- Guard Pond and Accessories:

The Guard Pond receives the effluents from different sources through an inlet baffle as described elsewhere in this specification. The overflow from the Guard pond is collected in a common collection outlet chamber connected to Guard pond Effluent Transfer pumps, to transfer effluent to the Flash Mixer/Flocculation Tank/Inclined Surface Settler for further treatment. These pumps upon selection shall start and stop automatically through the level switch. The pump will start at High level in the basin and preset low level in Guard pond will trip the pumps.

Alum Solution Transfer Cum Recirculation Pumps are provided in 2 nos. (1 working + 1 standby). The Alum Solution Transfer Cum Recirculation Pump are started manually and tripped by the low level switch installed in each of Alum Solution Preparation Tanks.

6.00.00 EQUIPMENT AND ACCESSORIES

The equipment and accessories to be supplied, installed as well as put into operation and all other required services are outlined herein under. The items, though not specifically mentioned but needed to make the system complete in all respects and reliable for safe and smooth operation and guaranteed performance shall also be treated as though included and the same shall be furnished, unless otherwise specifically excluded elsewhere.

Overall scope of work under this package shall be as specified in various specifications attached subsequently and as described in the following clauses. The Tenderer shall also refer to the various drawings enclosed with the specification for general guidelines of the minimum requirement under this specification.

Equipment and accessories as envisaged but not limited to, are in follows:

- i) Backwash Waste Water from Side Stream Filtration
 - a) One (1) no. Retention Pit complete with all accessories for backwash wastewater from Side Stream Filtration System.
 - b) Two (2) nos. Backwash Waste Water Transfer Pumps, each with drive motor and all other accessories.
- ii) Boiler Blowdown
 - a) One (1) no. Boiler Blow Down Quenching Pit complete with all accessories.
 - b) Three (3) nos. Boiler Blow down transfer Pumps, each with drive motor and all other accessories.
- iii) Oil Handling Area Effluent/service oily waste effluent
 - a) One (1) no. Retention pit for oily effluent from Fuel Oil Storage Area complete with all accessories.
 - b) Two (2) nos. Transfer pumps for Fuel Oil Storage oily effluent, each with drive motor and all other accessories.
 - c) One (1) no. Retention pit for service oily waste from Power House area complete with all accessories.
 - d) Two (2) nos. Transfer pumps for service oily waste from Power House, each with drive motor and all other accessories.
 - e) One (1) no. Pre Oil Water Separator Collection Pit complete with all accessories.
 - f) Two (2) nos. Transfer pumps, each with drive motor and all other accessories for Pre Oil Water Separator Collection Pit with all accessories.
 - g) One (1) no. CPI type Oil Water Separator with all accessories.
 - h) One (1) no. Slope Oil Tank with all accessories.
 - i) One (1) no. Retention Pit complete with all accessories for treated effluent from Oil Water Separator.

- j) Two (2) nos. Transfer pumps, each with drive motor and all other accessories for treated effluent from Oil Water Separator.
- k) One (1) no. CPI Sludge Sump (with two compartments) complete with all accessories.
- l) Two (2) nos. CPI Sludge Disposal Pumps each complete with electrical drive motor and all other accessories.
- m) Two (2) nos. Air Blowers, each complete with electrical drive motor and all other accessories.
- iv) Coal Pile Rainfall Runoff
 - a) One (1) no. Settling Pond (With two compartments) complete with all accessories.
 - b) One (1) no. Decanted Water Sump complete with all accessories.
 - c) Two (2) nos. Decanted Water Transfer pumps, each with drive motor and all other accessories.
 - d) Two (2) nos. Coagulant Aid Dosing Tanks each complete with agitator, electric drive motor and all other accessory.
 - e) Two (2) nos. Coagulant Dosing Pumps, each with drive motor and all other accessories.
 - f) One (1) no. Alkali Dosing Tank complete with agitator, electric drive motor and all other accessories.
 - g) Two (2) nos. Alkali Dosing Pumps, each with drive motor and all other accessories.
- v) Guard Pond (GP) complete with all accessories
 - a) One (1) no Guard Pond (with 2 compartments) complete with all accessories.
 - b) Three (3) nos. Guard Pond Effluent Transfer Pumps, each with drive motor and all other accessories.
 - c) One (1) no. Alkali Dosing Tank complete with agitator, electric drive motor and all other accessories.
 - d) Two (2) nos. Alkali Dosing Pumps, each with drive motor and all other accessories.
 - e) One (1) no. Acid Dosing Tank complete with agitator, electric drive motor and all other accessories.

- f) Two (2) nos. Acid Dosing Pumps, each with drive motor and all other accessories.
- vi) Guard Pond Waste Treatment & Recycling System
 - a) Three (3) nos. Flash Mixers complete with all accessories
 - b) Three (3) nos. Flocculation Tanks complete with all other accessories.
 - c) Three (3) nos. Inclined Surface Settlers each complete with all accessories.
 - d) Two (2) nos. Alum solution preparation tank each complete with agitator, electric drive motor and all other accessories.
 - e) Two (2) nos. Alum Solution Dosing Pumps, each complete with electrical drive motor and all other accessories.
 - f) One (1) no. Sludge Sump (with two compartments) complete with all accessories.
 - g) Two (2) nos. Sludge Disposal Pumps each complete with electrical drive motor and all other accessories.
 - h) Two (2) nos. Sludge Drying Beds complete with all accessories.
 - i) Two (2) nos. Air Blowers, each complete with electrical drive motor and all other accessories.
 - j) One (1) no. Clear Water Reservoir (with two compartments) complete with all accessories.
 - k) Three (3) nos. Clear Water Transfer Pumps, each with drive motor and all other accessories.
 - l) One (1) no. single storied Chemical House to accommodate storage space for chemicals, Chemical Solution Preparation Tanks, Dosing Pumps etc.
- 6.01.00 All integral and interconnected pipe works, valves, sump, gates, all types of pipe supports, pipe and cable racks, pipe and cable bridges, etc. for each system of the entire Effluent Treatment System.
- 6.02.00 Isolation Gates and Shutters as required and each complete with all accessories.
- 6.03.00 With reference to complete civil, structural and architectural works inclusive of all civil works for pipe trenches, drain trenches and cable trays/racks/trenches for the entire Plant Effluent Water Treatment System Bidder may please refer to Volume II-G/1 and Volume II-G/2 of Technical Specification.
- 6.04.00 With reference to the scope of electrical work Bidder may please refer to

Volume II-F/1 and Volume II-F/2 of this Technical Specification.

- 6.05.00 With reference to complete instrumentation and control Bidder may please refer to Volume II-E of this Technical Specification.
- 6.06.00 Supply and application of shop painting and final painting at site for the Waste Water Treatment System as specified elsewhere in this specification.
- 6.07.00 New and unused set of Mandatory Spares for two (2) years of normal operation of equipment, instruments etc. as enclosed with this specification.
- 6.08.00 New and unused set of Spares as recommended by the Tenderer for two (2) years of operation of equipment, instruments etc. covered under this specification.
- 6.09.00 Commissioning Spares for installation, testing and commissioning of all equipment, pipe works, instrumentation and control etc. covered under this specification. This shall include necessary cleaning, reliability run and performance guarantee test of the individual equipment as well as the entire package as a whole.
- 6.10.00 One new set of special tools and tackles, fixtures etc., as required for regular operation and maintenance of the Plant Effluent Water Treatment System. Adequate means shall be provided for lifting and handling of each item of plant and equipment.
- 6.11.00 Gas electrodes, paints, putty, and all other consumables required for erection, testing and commissioning purpose.
- 6.12.00 First fill of all lubricants, servo fluids and chemicals. The consumption during the trial operation and final filling/topping up after the trial operation shall also be included in the Tenderer's scope. Tenderer shall also furnish in separate containers quantity not less than 10% of the full charge of each variety of lubricants, servo fluids and the chemicals used.

7.00.00 SYSTEM BOUNDARIES

Interface points of the complete package to be supplied shall be as follows. For all Interface points, scope shall include making the joint including supply of matching counter flanges, gaskets, bolts, nuts, etc. as applicable.

- a) Backwash waste from Filters shall be received at the inlet of Retention Pit for Backwash Waste from Filters.
- b) One (1) no. outlet pipeline from discharge header of Filter Backwash Waste Transfer Pumps shall deliver the Backwash Waste at inlet of existing Clarifier.
- c) Backwash waste from Side Stream Filters shall be received at the inlet of Retention Pit for Backwash Waste from SSFs.

- d) One (1) no. outlet pipeline from discharge header of Sludge Transfer Pumps shall be terminated at a suitable point to Sludge Drying Bed.
- e) Neutralized waste from Demineralization plant shall be received at Guard pond.
- f) Quenched boiler blow down shall be received at Boiler Blow Down Drain Pit.
- g) Oily waste from Fuel Oil Storage Area shall be received at Retention Pit for Oily Waste from Fuel Oil Storage Area.
- h) Service oily waste from Power House Area shall be received at Retention Pit for Service oily Waste from Power House Area.
- i) Oily waste from Transformer Yard Area shall be received at Pre Oil Water Separator Collection Pit.
- j) One (1) no. outlet pipeline from discharge header of Treated Effluent from Oil Water Separator Transfer Pumps shall deliver treated water at CHP D/S area.
- k) Neutralized effluent from CPU shall be received at Guard pond.
- l) Coal pile run-off shall be received at Coal Particle Settling Basin.
- m) One (1) no. bypass channel to Coal Particle Settling Basin shall be terminated at a suitable point to deliver storm water into nearest Storm Water Drain.
- n) One (1) no. outlet pipeline from discharge header of Decanted Water Transfer Pumps shall deliver treated water at rain water harvesting pond.
- o) Clear Water Transfer Pumps shall deliver treated water to Ash Handling Plant and for gardening.
- p) Each of drains, vents and overflow lines from all equipment are to be taken into nearest drain pocket or drain trench.
- q) Service water terminals shall be provided at five suitable points.

8.00.00 DESIGN AND CONSTRUCTION

8.01.00 Oil Water Separator

8.01.01 The system shall be designed to handle rated flow. Hydraulics of the plant shall be such as to take an occasional overloading of 20% of the design flow rate.

8.01.02 The separator shall be of Steel construction/RCC and of proven design. It shall be provided with Walkway Bridge and platform to approach all the internals. Clear width of the bridge shall not be less than 1200 mm.

- 8.01.03 Suitable means for collection shall be provided for sludge emanating from the tube / plate separator. Further suitable system for treatment and disposal of this sludge shall be offered.
- 8.01.04 Suitable means for collection shall be provided for sludge emanating from the tube / plate separator. Further suitable system for treatment and disposal of this sludge shall be offered.
- 8.01.05 The separator periphery shall have sufficient width to have an easy walkway along with hand railing for general inspection. Access ladders with platforms and hand railing shall be provided in the separator for good approach. Permanent ladders (if required) shall also be provided (not rungs) for approaching the sludge pipe line valves for maintenance.
- 8.01.06 Suitable sampling connections shall be provided for performance monitoring.
- 8.01.07 The tube/plate type separator shall be circular/ rectangular with distinct tube/plate separation zone, sludge thickener zone, clear water zone and oil skimming zone.
- 8.01.08 The separator shall be counter flow or cross flow type. Co flow type units are not acceptable.
- 8.01.09 The unit shall be designed with minimum side water depth of 4 M. The overall area of unit shall be based on an average flow velocity not more than 5 m³/hr./m².
- 8.01.10 The inclined tubes/plates shall be spaced such that stable flow conditions are available. The flow through the tubes/plates shall be viscous/laminar. The cross sectional area of each tube shall be such that the effective hydraulic diameter is 80 mm (min.). The material of tube pack shall be UV inhibited virgin PVC. In case of plate type separator the distance between the successive plates shall be 50 mm (min.). The plate shall be made of GRP (glass reinforced plastic). The resin for the manufacturing of GRP plates shall be orthophthallic type.
- 8.01.11 The length of the tubes / plates through which the water flows shall not be less than 1.5 m.
- 8.01.12 The tubes / plates shall be inclined by 50 – 60 deg. Angle to the horizontal. The tubes / plates shall be arranged such that the complete water travels through the tubes all across the cross section of separator.
- 8.01.13 To remove settled particles from the plates/tubes suitable water jet arrangement shall be provided. Pumping and piping arrangement shall be separately provided for this purpose. The tube / plates shall be easily accessible for the cleaning purpose. The tube pack plates shall be placed inside the separator such that these may be individually removed for maintenance even when separator is operating. The entire pack shall be rigid and shall not deflect by self weight, water load or operator movement over the pack.

- 8.01.14 Treated water shall be collected in a trough provided with adjustable weir.
- 8.01.15 The unit shall be capable of delivering constant effluent water quality without any sludge / oil carryover, even at the time of rapid change in influent water quality, or changes in raw water temperature.
- 8.01.16 The Tenderer shall justify the design basis of entire plate/tube type separator unit and individual components of all the unit with back up calculations and also by means of supplying documentary evidence from their earlier installed plants in the form of drawings, certificates, etc.
- 8.01.17 The separator shall employ positive sludge system of consistent density, central sludge concentrating sump, water flushing nozzles etc. as per the standard design of manufacturer. Sludge removal system shall be designed to thicken the sludge to min. 2% consistency before disposing from separator bottom. All the pipelines carrying the sludge shall be provided with flushing connection. The pumps and piping required for flushing purpose shall be separately provided.
- 8.01.18 Sludge blow-off shall be affected by the static head of water in the separator. Sludge outlet pipe from the concentrated sludge hopper shall be branched into main disposal line. Main sludge disposal line should consist of blow-off valve which would be operated manually and drain sludge to the sludge disposal sump or the drain as specified.
- 8.01.19 This would be an intermittent operation. Continuous sludge disposal line shall consist of a telescopic stand pipe, the top of which would be maintained at a desired elevation to ensure trickle flow of water or sludge water mixture to the sludge sump.
- 8.01.20 The plant shall operated from a relay logic based panel with all safety interlocks, alarms and annunciations built into the system.
- 8.01.21 Painting for the entire scope under this specification shall be as per SECTION-IV attached with this specification.
- 8.02.00 **Coal Particle Settling Basin**
- 8.02.01 The waste water from the CHP contain coal particles which will be arrested before the waste is finally disposed. Apart from this coal pile runoff water during rainstorm will also contain large quantity of coal particles. These will also be settled before the disposal of rainstorm water.
- 8.02.02 For this purpose Coal Particle Settling Basin will be provided. All drains emanating from coal stockyard and coal handling plant will be routed to the settling pond by gravity channels. Clear water will be disposed to Rainwater Harvesting Pond.
- 8.02.03 This arrangement has been provided to prevent the tendency of short-circuiting of the incoming coal pile run off water in which there are chances of including water sliding through the top surface of the stored water. By provision of a separate wall the active area of cross section of flow of water will be utilized and this will maintain desired low flow velocities in the coal settling pond. A cleaning access ramp shall be provided for vehicle access to coal settling ponds so that settled coal particles can be removed whenever

required. Various regular drains of the coal handling plant shall be led to the coal setting pond by gravity and the drains shall be suitably designed and routed for this purpose. The effluent decanted water shall be discharged to storm water drain by gravity.

8.02.04 Coal pile settling ponds shall be designed to treat the maximum rain storm water run off from the coal pile and other areas with the potential of discharging coal particle laden run-off water. Sizing calculations shall support the selected capacity by the contractor.

8.02.05 The leachate from the coal stockpile will be acidic and may contain phenols and other hydrocarbons. The Tenderer shall arrange for the samples of coal stockpile runoff waste for design purpose from the power plant units and incorporate suitable treatment scheme so as to meet the stipulations of central and state pollution control board.

8.02.06 One (1) no. settling pond (with two compartments) shall be provided along with isolation gates at the inlet. This shall permit dislodging of one compartment while the other is in use. Manual dislodging shall be carried out and rung ladder shall be provided for this.

8.02.07 The settling pond shall be designed as per relevant codes and supporting calculations shall be submitted for approval. Polymer dosing facility shall be provided in case the same is required.

8.03.00 **Instrumentation**

8.03.01 The Tenderer shall furnish all instruments, interlocks etc. as shown in drawings in accordance with respect to complete instrumentation and control as described in Volume II-E of this Technical Specification and Technical Data Sheets for Instrumentation and Control.

8.03.02 The Tenderer is also required to supply all other necessary instruments for safe and trouble free operation of the plant Tendered even when specified reference to these instruments has not been made in the specification.

9.00.00 **INSPECTION, TESTING AND COMMISSIONING, PERFORMANCE GUARANTEE**

9.01.00 **Tests at Manufacturer's Works**

Shop tests shall include all tests to be carried out at Bidder's works, works of their sub-vendors and at works where raw materials to be used for fabrication of equipment are manufactured. The tests to be carried out shall include but not be limited to the following:

9.01.01 Composition of all material, castings, forgings, etc.

9.01.02 Hydraulic tests for valves, pump casing etc.

9.01.03 Tests to check faults in rubber lining [as per IS-4682 (Part-I) or its equivalent] and painting.

9.01.04 Static balancing tests on agitators etc.

- 9.01.05 Static and dynamic balancing tests on all impellers.
- 9.01.06 Performance tests (Head, Capacity and Power) for each of pumps and blowers.
- 9.01.07 Tests of all electrical equipment/accessories as specified in respective electrical sub-sections.
- 9.01.08 Control Systems are to be checked for dimensions, wiring continuity, insulation, tubing leakage etc.
- 9.01.09 All instruments and accessories are to be checked for performance, over range protection etc. as per I.S.A. or other relevant standards.
- 9.01.10 Calibration tests of all standard orifices, nozzles, pressure & other instruments.
- 9.01.11 Functional tests of the control system.
- 9.01.12 Load tests for monorail hoists.
- 9.02.00 **Tests at Site Before Trial Run**
- Tenderer shall carry out tests at site to prove to the Purchaser that each equipment of the plant complies with the requirements stipulated and is erected in accordance with requirements. Before the plant is put on trial run the Bidder will be required to conduct tests to demonstrate to the Purchaser that each item of the plant is capable of correctly performing the functions for which it was specified to. These tests may be conducted concurrently with those required under commissioning sequence. Tests required shall in general be as follows:
- 9.02.01 All piping and valves, after installation, will be tested hydrostatically at a pressure, one and half times of the maximum attainable pressure in the system, to check against leak tightness.
- 9.02.02 All valves/gates (Manual/Automatic/Remotely Operated) shall be operated throughout 100% of the travel and these should function without any trouble whatsoever.
- 9.02.03 All pumps shall be run with the specified fluid from shut off conditions to valve wide-open condition. Head developed will be checked from the discharge pressure gauge reading. Capacity may be checked from flow indicators where applicable. If flow indicators are not available in the system capacity can be checked from the volume of fluid handled (determined from level indicator reading of concerned tank) and duration of test.
- 9.02.04 During the test, the pumps and drive motors shall run smoothly without any undue vibration, leakage through gland, temperature rise in the bearing parts, noise, flow pulsation etc.
- 9.02.05 Pumps, blowers etc. shall be tested at site to run smoothly without undue vibration, flow pulsation, temperature rise in bearing parts, noise etc.

- 9.02.06 The tests to be carried out for the fabricated storage vessels are to include:
- i) During fabrication and before lining:
 - a) Bottom testing for leakage by soap solution, after the bottom and at least the bottom course of the shell plate have been welded.
 - b) Hydraulic shell testing for leakage.
 - c) Fixed roof test for leakage by soap solution.
 - ii) After rubber lining:

Water leakage test for storage tank by filling it with water up to the overflow level.
- 9.02.07 All the rubber lining are to be subjected to the following tests as per IS:4682 (Part-I).
- i) Adhesion test
 - ii) Resistance to bleeding
 - iii) Thickness measurement
 - iv) Shore hardness
 - v) High voltage spark test
- Epoxy painting shall be checked by dry type thickness gauge.
- 9.02.08 Visual check on all structural components, welding, rubber lining, painting etc. and if doubt arises these will be tested again.
- 9.02.09 All testing and calibrating instruments and equipment need to be arranged by the Bidder free of cost to the satisfaction of the Purchaser.
- 9.02.10 All monorail hoists shall be subjected to full working load during all motions without showing any sign of defect.
- 9.02.11 All the rotating/moving components shall be run at the rated speed with water/chemicals up to the normal water level for a period of twenty-four (24) hours. During this period all the components shall function smoothly without any unbalance, vibration, overheating at bearing parts etc.
- 9.02.12 Checks on electrical items as mentioned under electrical specifications enclosed herewith.

9.03.00 Performance Guarantee Test Procedure

9.03.01 Necessary pumps shall be started and flow shall be established through all the streams. Valves be adjusted so as to have equal and rated distribution of flow through all the streams.

9.04.00 Performance Guarantee parameters for Effluent Treatment Plant

- i) Each pump shall be guaranteed for capacity, total dynamic head and power consumption.
- ii) All blowers shall be guaranteed for head and power consumption.
- iii) Capacity and qualities for effluents from different streams are as follows:

Oil Water Separator

- ◆ The unit will have rated output capacity (net) not less than Oily waste transferred by Fuel Oil Storage Area Oily Waste Transfer Pump per hour + Power House Area service Waste Transfer Pump per hour + Common Oil Pit Transfer Pump (located in Transformer Yard Area) per hour
- ◆ Oil content at the outlet shall not exceed 10 ppm for 1000 ppm (maximum) Oil content at the inlet
- ◆ Suspended Solids at the outlet shall not exceed 100 ppm for 300 ppm (maximum) Suspended Solids at the inlet

Treatment System for Coal Pile Area Rainfall Run Off

Coal Particle Settling Basin

- ◆ The unit shall have minimum capacity to hold coal pile runoff generated in first half an hour of rainfall
- ◆ Suspended Solids at the outlet shall not exceed 20 ppm for 1000 ppm (maximum) Suspended Solids at the inlet

Treatment System for Guard Pond effluent :

- ◆ Normally, all three (3) Inclined Surface Settlers will operate in under-load condition. However, in case any one Inclined Surface Settler is taken out for maintenance, the other two Inclined Surface Settlers with 20 % overload will be able to cater for the total water requirement.
- ◆ Suspended Solids at the outlet shall not exceed 100 ppm.

ANNEXURE-I

EQUIPMENT DATASHEET

1.00.00	BACKWASH WASTE WATER FROM SIDE STREAM FILTRATION	
1.01.00	Backwash Waste Water Pit	
(A)	Number required	One (1)
(B)	Description (applicable for each sump)	
	Type	Underground, Rectangular with flat bottom.
	Type of fluid to be handled	Backwash waste from Side stream filtration system
	Effective capacity, m3 (min.)	100 % of waste generated per hour
	Material of Construction	RCC
1.02.00	Backwash waste water transfer pump	
(A)	Number required	Two (2) [One no. in operation and other as stand-by].
(B)	Description (applicable for each pump)	
	Type	Vertical Centrifugal type
	Location	Outdoor
	Fluid to be handled	Backwash waste from Side stream filtration system
	Duty	Intermittent
	Rated capacity, each m3/hr.	100 % of waste generated per hour
	Tentative Head to be developed at rated capacity, MLC	To be specified by the Supplier to meet the system requirements.
	Pump Speed, RPM	1500 preferred
	Material of Construction	
	Casing	2.5 % Ni Cl as per IS 210 FG 260
	Impeller	Stainless Steel – Gr. 316
	Shaft	Stainless Steel – Gr. 410
2.00.00	QUENCHED BOILER BLOW DOWN WATER RECYCLE SYSTEM	
2.01.00	Boiler Blow Down Drain Pit	
(A)	Number required	One (1)
(B)	Description (applicable for each sump)	
	Type	Underground, Rectangular with flat bottom.
	Type of fluid to be handled	Boiler Drain Waste Water
	Effective capacity, (min.)	100 % of quenched boiler blow down generated per hour
	Material of Construction	RCC
2.02.00	Boiler Blow Down Transfer Pumps	
(A)	Number required	Three (3) [Two (2) nos. in operation and One (1) as stand-by].
(B)	Description (applicable for each pump)	
	Type	Vertical Centrifugal type

	Location	Outdoor
	Fluid to be handled	Boiler Drain Waste Water
	Duty	Continuous
	Rated capacity, each m3/hr , (min.)	50 % of quenched boiler blow down generated per hour
	Tentative Head to be developed at rated capacity, MLC	To be specified by the Supplier to meet the system requirements.
	Pump Speed, RPM	1500 preferred
	Material of Construction	
	• Casing	2.5 % Ni Cl as per IS 210 FG 260
	• Impeller	Stainless Steel – Gr. 316
	• Shaft	Stainless Steel – Gr. 410
3.00.00	OIL HANDLING AREA/SERVICE WASTE WATER EFFLUENT	
	Range of free oil concentration in retention pit.	0-1000 mg/ l
	Total suspended solids.	300 mg/ l (max)
	Type of oil	LDO
	Sp. gravity of oil	0.9
	Kinematic viscosity of oil	2.5 to 15.7 Centistokes @ 380 C
3.01.00	Oily Waste from Fuel Oil Storage Area	
3.01.01	Retention Pit for Oily Waste from Fuel Oil Storage Area	
(A)	Number required	One (1)
(B)	Description (applicable for each sump)	
	Type	Underground, Rectangular with flat bottom.
	Type of fluid to be handled	Oily waste from Fuel Oil Storage area.
	Effective capacity,m3	100 % of oily waste generated per hour
	Material of Construction	RCC
3.01.02	Fuel Oil Storage Area Oily Waste Transfer pump	
(A)	Number required	Two (2) [One no. in operation and other as stand-by].
(B)	Description (applicable for each pump)	
	Type	Screw type
	Location	Outdoor
	Fluid to be handled	Oily Waste form Fuel Oil Storage Area.
	Duty	Intermittent
	Rated capacity each, m3/hr, (min.)	Suitable to transfer oily waste generated from Fuel Oil Area in a shift (8 hrs.)
	Tentative Head to be developed at rated capacity, MLC	To be specified by the Supplier to meet the requirements of the system.
	Pump Speed, RPM	1500 preferred
	Material of Construction	
	Casing	2 % Ni Cl to IS 210 FG 260
	Rotor	SS 316

	Stator	Nitrile /EPDM
	Shaft	SS 316
3.02.00	Service oily Waste From Power House Area	
3.02.01	Retention Pit for Service Waste from Power House Area	
(A)	Number required	One (1)
(B)	Description (applicable for each sump)	
	Type	Underground, Rectangular with flat bottom.
	Type of fluid to be handled	Service waste from Power House area.
	Effective capacity, m3,(min.)	100 % of waste generated per hour
	Material of Construction	RCC
3.02.02	Power House Area service Waste Transfer Pump	
(A)	Number required	Two (2) [One in operation and other as stand-by].
(B)	Description (applicable for each pump)	
	Type	Screw type
	Location	Outdoor
	Fluid to be handled	Service Waste from Power House area.
	Duty	Contineous
	Rated capacity each, m3/hr, (min.)	100 % of waste generated per hour
	Tentative Head to be developed at rated capacity, MLC	To be specified by the Supplier to meet the requirements of the system.
	Pump Speed, RPM	1500 preferred
	Material of Construction	
	Casing	2 % Ni Cl to IS 210 FG 260
	Rotor	SS 316
	Stator	Nitrile /EPDM
	Shaft	SS 316
3.03.00	Pre Oil Water Separator Collection Pit	
(A)	Number required	One (1)
(B)	Description (applicable for each sump)	
	Type	Underground, Rectangular with flat bottom.
	Type of fluid to be handled	Oily waste from Fuel Oil Storage Area, Power House area & Transformer Yard Area.
	Effective capacity, m3, (min.)	Suitable to receive oily waste transferred by Fuel Oil Storage Area Oily Waste Transfer Pump per hour + Power House Area service Waste Transfer Pump per hour + Common Oil Pit Transfer Pump (located in Transformer Yard Area) per hour
	Material of Construction	RCC

3.05.00	Pre Oil Water Separator Collection Pit Transfer Pump	
(A)	Number required	Two (2) [One (1) in operation and One (1) as stand-by].
(B)	Description (applicable for each pump)	
	Type	Screw type
	Location	Outdoor
	Fluid to be handled	Oily Waste from Pre Oil Water Separator Collection Pit
	Duty	Continuous
	Rated capacity, Cubic Meter per Hour., (min.)	Oily waste transferred by Fuel Oil Storage Area Oily Waste Transfer Pump per hour + Power House Area service Waste Transfer Pump per hour + Common Oil Pit Transfer Pump (located in Transformer Yard Area) per hour
	Tentative Head to be developed at rated capacity, MLC	To be specified by the Supplier to meet the requirements of the system.
	Pump Speed, RPM	1500 preferred
	Material of Construction	
	Casing	2 % Ni Cl to IS 210 FG 260
	Rotor	SS 316
	Stator	Nitrile /EPDM
	Shaft	SS 316
3.06.00	Oil Water Separator	
(A)	Number required	One (1)
(B)	Type	Plate or Tube with Counter Flow / Cross Flow.
	Duty	Continuous
	Rated output capacity, Cubic Meter per Hour., (min.)	Oily waste transferred by Fuel Oil Storage Area Oily Waste Transfer Pump per hour + Power House Area service Waste Transfer Pump per hour + Common Oil Pit Transfer Pump (located in Transformer Yard Area) per hour(Net)
	Treated water quality	Free Oil content not to exceed 10 ppm for free oil concentration 1000 ppm max. in feed waste to the Separator. Suspended Solids not to exceed 100 ppm for Suspended Solids 300 ppm max. in feed waste to the Separator.
	Design Criteria	
	Angle of inclination of Plates or Tubes	60 degree maximum.
	Rise Rate	Suitable to provide efficient coalescence and removal of oil from wastewater to maintain oil concentration 10 ppm max. in treated effluent.
	Material of Construction	
	Body	RCC / Carbon Steel / GRP

	Plates or Tubes	UV inhibited virgin FRP or GRP or PVC.
	Oil Skimmer System	To be provided.
	Sludge Disposal System	By gravity. All accessories to be provided.
3.07.00	Slop Oil Storage Tank	
	Number required	One (1).
	Type	Vertical Cylindrical.
	Type of fluid to be handled	Slop Oil.
	Effective capacity,m3	3 (min.)
	Material of Construction	Carbon Steel
3.08.00	Retention Pit for Treated Water from Oil Water Separator	
(A)	Number required	One (1)
(B)	Description (applicable for each sump)	
	Type	Underground, Rectangular with flat bottom.
	Type of fluid to be handled	Treated water from Oil-Water Separator
	Effective capacity, m3,(min.)	100 % of treated water generated from Oil Water Separator per hour
	Material of Construction	RCC
3.09.00	Oil Water Separator treated Effluent transfer Pump	
(A)	Number required	Two (2) [One (1) in operation and other as stand-by].
(B)	Description (applicable for each pump)	
	Type	Screw type
	Location	Outdoor
	Fluid to be handled	Treated water from Oil-Water Separator
	Duty	Continuous
	Rated capacity each, m3/hr,(min.)	100% of treated water generated from Oil Water Separator per hour
	Tentative Head to be developed at rated capacity, MLC	100 % of treated water generated from Oil Water Separator per hour
	Pump Speed, RPM	1500 preferred
	Material of Construction	
	Casing	2 % Ni Cl to IS 210 FG 260
	Rotor	SS 316
	Stator	Nitrile /EPDM
	Shaft	SS 316
3.10.00	CPI sludge pit	
A)	Numbers To be provided	One (1)
B)	Description	
	Type	Rectangular with flat bottom.
	Type of fluid to be handled	Sludge from Oil Water separator
	Effective capacity of each compartment, m3,(min.)	Not less than 100 % of sludge generated from Oil Water Separator in

		8 hours
	Material of Construction	RCC.
	Type of protection	
	Internal	Epoxy painted.
3.11.00	CPI Sludge Pit Blower	
A)	Number	Two (2) nos. [One (1) in operation and other as standby]
B)	Description for each Blower	
	Location	Outdoor
	Fluid to be handled	Ambient Air.
	Service	Sludge mixing
	Duty	Intermittent
	Type of Blower	Rotary, twin lobe
	Rated Capacity	Suitable to meet 100% of system requirements
	Head to be developed at rated capacity	Tendered to indicate, to ensure the satisfactory performance.
	Material of construction	
	Casing	CI to IS 210 FG 260
	Lobes	CS to BS 970, EN9 Forged
	Shaft	CS to BS 970, EN9 Forged
3.12.00	CPI Sludge Transfer Pump	
A)	Number required	Two (2) [One in operation and other as stand-by].
B)	Description (applicable for each pump)	
	Type	Vertical Centrifugal type
	Location	Outdoor
	Fluid to be handled	CPI sludge
	Duty	Intermittent
	Rated capacity, each m ³ /hr.	Suitable to transfer 100 % of sludge generated from Oil Water Separator in 8 hours , within 1 hour.
	Tentative Head to be developed at rated capacity, MLC	To be specified by the Supplier to meet the system requirements.
	Pump Speed, RPM	1500 preferred
	Material of Construction	
	Casing	2.5 % Ni CI as per IS 210 FG 260
	Impeller	Stainless Steel – Gr. 316
	Shaft	Stainless Steel – Gr. 410
4.00.00	COAL HANDLING PLANT (CHP)'S WASTE WATER	
	Total suspended solids	1000 ppm
	Specific gravity of coal particles	1.2
	Sizes of particles to be settled	50 microns and above
	Maximum rainfall considered	45 mm/hr
4.01.00	Coal Particle Settling Basin	
A)	Number required	One (1) [twin compartment]
B)	Description (applicable for each	

	compartment)	
	Type	Underground.
	Type of fluid to be handled	Rainfall Runoff from coal pile area
	Effective capacity (for each compartment), (min.)	Capacity shall be adequate to hold coal pile runoff generated in first half an hour of rainfall
	Material of Construction	RCC
4.02.00	Decanted Water Sump	
A)	Number required	One (1)
B)	Description (applicable for each sump)	
	Type	Underground.
	Type of fluid to be handled	Decanted water
	Effective capacity, (min.)	100 % decanted water generated
	Material of Construction	RCC
4.03.00	Decanted Water Transfer Pumps	
A)	Number required	Two (2) [Two in operation and other as stand-by].
B)	Description (applicable for each pump)	
	Type	Vertical Centrifugal
	Location	Outdoor
	Fluid to be handled	Decanted water
	Duty	Intermittent
	Suction Condition	Flooded
	Rated capacity, Cubic Meter per Hour,(min.)	Suitable to transfer 100% decanted water generated within a shift (8 hrs.)
	Tentative Head to be developed at rated capacity, MLC	To be specified by the Supplier to meet the system requirements.
	Range of Operation (%)	30-120
	Pump Speed, RPM	1500 preferred
	Material of Construction	
	Casing	2.5 % Ni Cl as per IS 210 FG 260
	Impeller	Stainless Steel – Gr. 316
	Shaft	Stainless Steel – Gr. 410
4.04.00	Alkali Dosing Tank	
A)	Numbers required	One (1)
B)	Description (applicable for each Tank)	
	Type	Vertical rectangular with flat bottom
	Location	Chemical House for Coal Rainfall Runoff
	Type of fluid to be handled	Alkali Solution
	Effective capacity, m3	24 hour storage of 100% requirement of plant at full load condition
	Material of Construction	FRP
	Agitator	
	a) Number	One (1)
	b) MOC	SS 316
4.05.00	Alkali Dosing Pump	
A)	Number	Two (2) [One (1)] no. to be under

		operation and the other as standby
B)	Description for each Pump	
	Type of Pump	Metering pumps, Simplex , mechanically actuated (hydraulically operated)diaphragm type
	Location	Chemical House for Coal Rainfall Runoff
	Fluid to be handled	Alkali solution
	Rated Capacity each, m3/hr	Suitable to meet 100% of system requirements
	Tentative head to be developed at rated capacity, MLC	To be specified by the Supplier to meet the requirements of the system
	Range of Operation (%)	10 – 100
	Pump Speed, (RPM)	1500 preferred
	Material of construction	
	a) All wetted parts	SS-316.
	b) Diaphragm	PTFE
4.06.00	Coagulant Aid Dosing Tank	
A)	Numbers required	Two (2)
B)	Description (applicable for each Tank)	
	Type	Vertical rectangular with flat bottom
	Location	Chemical House for Coal Rainfall Runoff
	Type of fluid to be handled	Coagulant aid solution
	Effective capacity, m3	12 hour storage of 100% requirement of plant at full load condition
	Material of Construction	FRP
	Agitator	
	a) Number	One (1)
	b) MOC	SS 316
4.07.00	Coagulant Aid Dosing Pump	
A)	Number	Two (2) [One (1)] no. to be under operation and the other as standby
B)	Description for each Pump	
	Type of Pump	Metering pumps, Simplex , mechanically actuated (hydraulically operated) diaphragm type
	Location	Chemical House for Coal Rainfall Runoff
	Fluid to be handled	Coagulant aid solution
	Rated Capacity each, m3/hr	Suitable to meet 100% of system requirements
	Tentative head to be developed at rated capacity, MLC	To be specified by the Supplier to meet the requirements of the system
	Range of Operation (%)	10 – 100
	Pump Speed, (RPM)	1500 preferred
	Material of construction	
	a) All wetted parts	SS-316.
	b) Diaphragm	PTFE

5.00.00	GUARD POND	
	Number	One (1)
	No. of compartments	Two (2)
	Type	Underground, Rectangular truncated pyramid type
	MOC	Earthen with clay blanket & riprap coating
	Minimum Effective capacity (Each Compartment), m3	Not less than 1500
	Inlet Arrangement	Inlet chamber with gate
	MOC of Inlet Chamber	RCC
6.00.00	GUARD POND EFFLUENT TRANSFER PUMP	
A)	Number	Three (3) [Two (2)] no. to be under operation and One(1) no. as standby
B)	Description for each Pump	
	Type of Pump	Vertical Centrifugal type
	Location	Indoor
	Fluid to be handled	Water from Guard pond
	Duty	Continuous
	Rated Capacity each, m3/hr, (min.)	Suitable to transfer 50 % of maximum waste received per hour
	Tentative head to be developed at rated capacity, MLC	To be specified by the Supplier to meet the requirements of the system
	Range of Operation (%)	10 – 100
	Pump Speed, (RPM)	1500 preferred
	Material of construction	
	a) Casing	CI IS-210, FG 260
	b) Impeller	Bronze IS 318, GR. LTB2
	c) Shaft	CS to BS 970, EN 8
7.00.00	ACID DOSING TANK	
A)	Numbers required	One (1)
B)	Description (applicable for each Tank)	
	Type	Vertical rectangular with flat bottom
	Location	In the vicinity of Guard pond Pump House
	Type of fluid to be handled	Acid Solution
	Effective capacity, m3	Suitable to meet 100% of system requirements
	Material of Construction	FRP
	Agitator	NA
8.00.00	ACID DOSING PUMP	
A)	Number	Two (2) [One (1)] no. to be under operation and the other as standby
B)	Description for each Pump	
	Type of Pump	Metering pumps, Simplex, mechanically actuated (hydraulically operated)diaphragm type

	Location	In the vicinity of Guard pond Pump House
	Fluid to be handled	Acid Solution.
	Rated Capacity each, m3/hr	Suitable to meet 100% of system requirements
	Tentative head to be developed at rated capacity, MLC	To be specified by the Supplier to meet the requirements of the system
	Range of Operation (%)	10 – 100
	Pump Speed, (RPM)	1500 preferred
	Material of construction	
	All wetted parts	SS-316.
	Diaphragm	PTFE
9.00.00	ALKALI DOSING TANK	
A)	Numbers required	One (1)
B)	Description (applicable for each Tank)	
	Type	Vertical rectangular with flat bottom
	Location	In the vicinity of Guard pond Pump House
	Type of fluid to be handled	Alkali Solution
	Effective capacity, m3	Suitable to meet 100% of system requirements
	Material of Construction	FRP
	Agitator	
	a) Number	One (1)
	b) MOC	SS 316
10.00.00	ALKALI DOSING PUMP	
A)	Number	Two (2) [One (1)] no. to be under operation and the other as standby
B)	Description for each Pump	
	Type of Pump	Metering pumps, Simplex , mechanically actuated (hydraulically operated)diaphragm type
	Location	In the vicinity of Guard pond Pump House
	Fluid to be handled	Alkali Solution.
	Rated Capacity each, m3/hr	Suitable to meet 100% of system requirements
	Tentative head to be developed at rated capacity, MLC	To be specified by the Supplier to meet the requirements of the system
	Range of Operation (%)	10 – 100
	Pump Speed, (RPM)	1500 preferred
	Material of construction	
	All wetted parts	SS-316.
	Diaphragm	PTFE
11.00.00	FLASH MIXER	
A)	Numbers To be provided	Three (3).
B)	Description for Unit	
	Type	Flash mixer provided with baffle wall

		inside.
	Effective Capacity , (min.)	Normally, all three (3) Flash Mixers will operate in under-load condition. However, in case any one Flash Mixer is taken out for maintenance, the other two Flash Mixers with 20 % overload will be able to cater for the total water requirement.
	Design residence time	60 sec
	Material of Construction	RCC
	Agitator	MS Epoxy painted, Motor driven
12.00.00	FLOCCULATION TANK	
A)	Numbers To be provided	Three (3).
B)	Description for Unit	
	Type	RCC tank provided with baffle wall inside.
	Effective Capacity ,(min.)	Normally, all three (3) Flocculation Tanks will operate in under-load condition. However, in case any one Flocculation Tanks is taken out for maintenance, the other two Flocculation Tanks with 20 % overload will be able to cater for the total water requirement.
	Design residence time	30 min
	Material of Construction	RCC
v.	Agitator	MS Epoxy painted, Motor driven
13.00.00	INCLINED SURFACE SETTLER	
A)	Number to be provided	Three (3).
B)	Description for each Settler	
	Type	Plate Settlers/Tube Settler
	Output Capacity for each at rated condition, m3/hr	Normally, all three (3) Inclined Surface Settlers will operate in under-load condition. However, in case any one Inclined Surface Settler is taken out for maintenance, the other two Inclined Surface Settlers with 20 % overload will be able to cater for the total water requirement.
	Suspended solids in treated water at rated condition, ppm	Not to exceed 100
	Surface flow rate	Not exceed to 1.2 m2/m3/hr (based on Projected Effective Surface Area)
	Material of Construction	
	a) Body	RCC
	b) Plate/tube	FRP
	Sludge disposal arrangement	
	➤ Intermittent	Main sludge disposal line shall consist of manual adjustable timer operated blow-off valve with manual over riding facilities

	➤ Continuous	By gravity
14.00.00	SLUDGE SUMP	
A)	Numbers To be provided	One (1) number with two compartments
B)	Description	
	Type	Rectangular with two compartments and flat bottom.
	Type of fluid to be handled	Sludge from Inclined Surface Settler as well from CPI Sludge Pit
	Effective capacity of each compartment m3/hr	Suitable to hold sludge generated from three (3) nos. Inclined surface Settlers and CPI Sludge Pit at rated condition for 1 hr.
	Minimum Free Board, in mm.	500
	Material of Construction	RCC.
	Type of Protection	
	Internal	Epoxy painted as per relevant sub section.
	External	Not applicable
	Instruments	To be provided as per P&ID, enclosed with the Specification.
15.00.00	SLUDGE TRANSFER PUMPS	
A)	Number required	Two (2) [One in operation and other as stand-by].
B)	Description (applicable for each pump)	
	Type	Vertical Centrifugal type
	Location	Outdoor
	Fluid to be handled	Sludge generated from Inclined surface Settler
	Duty	Intermittent
	Rated capacity, each m3/hr.	Suitable to transfer 100 % of sludge generated from three (3) nos. Inclined surface Settlers as well as CPI Sludge Pit at rated condition. within 1 hour.
	Tentative Head to be developed at rated capacity, MLC	To be specified by the Supplier to meet the system requirements.
	Pump Speed, RPM	1500 preferred
	Material of Construction	
	Casing	2.5 % Ni Cl as per IS 210 FG 260
	Impeller	Stainless Steel – Gr. 316
	Shaft	Stainless Steel – Gr. 410

16.00.00	ALUM SOLUTION PREPARATION TANKS	
A)	Numbers required	Two (2)
B)	Description (applicable for each Tank)	
	Type	Vertical rectangular with flat bottom
	Type of fluid to be handled	10 % w/w Alum Solution.
	Effective capacity of each tank, m3/hr	Adequate to hold the quantity required for twelve (12) hours of operation of three (3) nos. Inclined Surface Settlers each set at rated capacity plus water loss for sludge disposal through each Clarifier.
	Free Board, mm	300
	Size	Tenderer to indicate.
	Design Pressure, Kg/sq. cm (g)	As per Tender Specification.
	Design Temperature, 0C	60
	Design Code	As per Tender Specification.
	Code for Test and Inspection	As per Tender Specification.
	Material of Construction	RCC.
	Protection	
	Internal	Acid Proof Tile Lining
	External	Not applicable
	Agitator along with drive motor and all other accessories	
	Number	One (1) per Tank
	Material of Construction	SS 316
	d) Dissolving Basket	
	Number	One (1) per Tank
	Material of Construction	SS 316
17.00.00	ALUM SOLUTION INJECTION PUMPS	
A)	Number	Two (2) [One (1) no. to be under operation and the other as standby].
B)	Description for each Pump	
	Type of Pump	Positive displacement and hydraulic diaphragm type with stroke adjustment.
	Location	Indoor.
	Fluid to be handled	10 % w/w Alum Solution.
	Service	To dose Alum solution to the Inclined surface Settlers
	Duty	Continuous and suitable for parallel operation
	Suction Condition	Flooded
	Rated Capacity, m3/hr	100 % requirement at full load condition of the plant
	Tentative head to be developed at rated capacity, MLC	To be specified by the Supplier to meet the system requirements
	Design Standard	As per Tender Specification

	Design Temperature, 0C	60
	Range of Operation (%)	0 – 100
	Pump Speed, (RPM)	1500 preferred
	Material of construction	
	All wetted parts	SS-316.
	Diaphragm	PTFE
	Type of drive	Electrical Motor
	Rated speed (RPM)	1500 (Sync.) maximum.
18.00.00	AIR BLOWER FOR SLUDGE SUMP	
A)	Number	Two (2) nos. [One (1) in operation and other as standby]
B)	Description for each Blower	
	Location	Outdoor
	Fluid to be handled	Ambient Air.
	Service	Sludge mixing
	Duty	Intermittent
	Type of Blower	Rotary, twin lobe
	Rated Capacity	Suitable to meet 100% of system requirements
	Head to be developed at rated capacity	Tendered to indicate, to ensure the satisfactory performance.
	Material of construction	
	Casing	CI to IS 210 FG 260
	Lobes	CS to BS 970, EN9 Forged
	Shaft	CS to BS 970, EN9 Forged
19.00.00	CLEAR WATER RESERVOIR	
	Number	One (1)
	No. of compartments	Two (2)
	Type	Underground, Rectangular
	MOC	RCC
	Minimum Effective capacity (Each Compartment), m3	Adequate to hold water generated from Inclined Surface Settler in two (2) hours.
	Inlet Arrangement	Inlet chamber with gate
	MOC of Inlet Chamber	RCC
20.00.00	CLEAR WATER TRANSFER PUMPS	
A)	Number	Three (3) [Two (2)] no. to be under operation and One(1) no. as standby
B)	Description for each Pump	
	Type of Pump	Vertical Centrifugal type
	Location	Indoor
	Fluid to be handled	Water from Clear Water Reservoir
	Duty	Continuous
	Rated Capacity each, m3/hr, (min.)	To be specified by the Supplier to meet the requirements of the system
	Tentative head to be developed at rated capacity, MLC	To be specified by the Supplier to meet the requirements of the system
	Range of Operation (%)	10 – 100

	Pump Speed, (RPM)	1500 preferred
	Material of construction	
	a) Casing	CI IS-210, FG 260
	b) Impeller	Bronze IS 318, GR. LTB2
	c) Shaft	CS to BS 970, EN 8
21.00.00	SLUDGE DRYING BEDS	
A)	Number of Beds	Two (2)
B)	Dewatering, drying and sludge removal cycle (in Days)	Ten (10)
C)	Depth of application of sludge (in m)	0.3

ANNESURE-II

STANDARDS FOR DISCHARGE OF LIQUID EFFLUENTS
[As per Item 5 of Schedule-I of Environment (Protection) Rules]

Parameters in mg/l (Except for pH & Temperature)	Cooling Water once-through	Boiler Blowdown	Cooling Tower Blowdown	Ash Pond Effluent
pH	6.5 - 8.5			6.5 - 8.5 Preferable > 7.0
Temperature	Not more than 5°C higher than intake water temperature			
Suspended solid		100.0		100.0
Oil and grease		20.0		20.0
Free available chlorine	0.5		0.5	
Copper (total)		1.0		
Iron (total)		1.0		
Zinc			1.0	
Chromium (total)			0.2	
Phosphate			5.0	



**1x800 MW WANAKBORI STPP
TECHNICAL SPECIFICATION FOR
EFFLUENT TREATMENT PLANT**

SPECIFICATION No: PE-TS-408-164-A001

VOLUME: II B

SECTION : C 2B

REV. 00

DATE:

SECTION: C 2B

**CUSTOMER SPECIFICATIONS
TECHNICAL REQUIREMENT
(PROJECT SPECIFIC)**

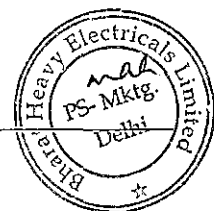
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VOLUME : IIA
SECTION-IV
GENERAL TECHNICAL REQUIREMENTS

(ONLY RELEVANT PORTION TO ETP TO BE REFFERED)



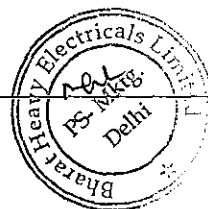
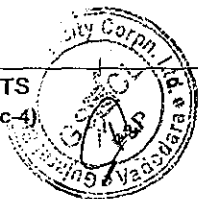
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SECTION-IV

GENERAL TECHNICAL REQUIREMENTS

1.00.00 CODES AND STANDARDS

1.01.00 Except where otherwise specified, the Plant shall comply with the appropriate Indian Standard or an agreed internationally accepted Standard Specification as listed in the annexure to this Section and mentioned in detailed specifications, each incorporating the latest revisions at the time of tendering. Where no internationally accepted standard is applicable, the Bidder shall give all particulars and details as necessary; to enable the Owner to identify all of the Plant in the same detail as would be possible had there been a Standard Specification.

1.02.00 Where the Bidder proposes alternative codes or standards he shall include in his tender one copy (in English) of each Standard Specification to which materials offered shall comply. In such case, the adopted alternative standard shall be equivalent or superior to the standards mentioned in the specification.

1.03.00 The plant will be designed in compliance with applicable National and International Codes and Standards such as ASME, ASTM, DIN, BS, IEC, IEEE, IS, etc. Wherever specified or required the Plant shall conform to various statutory regulations such as Indian Boiler Regulations, Indian Explosives Act, Indian Factories Act, Indian Electricity Act, Environmental Regulations, etc. Wherever required, approval for the plant supplied under the specification from statutory authorities shall be the responsibility of the Contractor.

1.04.00 In the event of any conflict between the codes and standards referred above, and the requirements of this specification, the requirements, which are more stringent, shall govern.

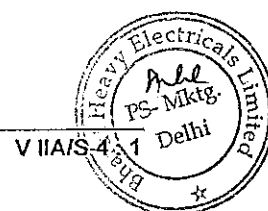
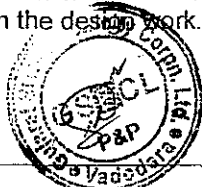
1.05.00 All latest codes & standards shall be considered upto the base date. The base date to be considered for codes and standards is fifteen (15) days prior to opening of price bid.

1.06.00 Successful Bidder to furnish two (2) sets of latest International Codes and Standards which have been used for their plants, equipments and system. IS Codes, ASME codes, ASTM codes need not to be furnished. However, International Performance Test Codes shall be furnished as applicable.

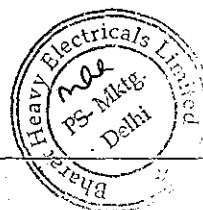
2.00.00 RESPONSIBILITY FOR DESIGN

2.01.00 The Contractor shall assume full responsibility for the design of the whole and every portion of the Plant, whether or not the design work was undertaken specifically in relation to the Contract and whether or not the Contractor was directly involved in the design work.

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- 2.02.00 Notwithstanding the Owner's wish to receive the benefits of new, advanced and improved technologies, a prime requirement is that all the systems and components proposed shall have been already adequately developed and shall have demonstrated good reliability under similar, or more arduous conditions elsewhere, at least for continuous 2 years in two different power station.
- 2.03.00 The successful bidder shall have to carry out surge analysis, BFP transient analysis and other transient condition studies as may be necessary and as required by the Owner as per proven engineering practice.
- 2.04.00 Bidder shall comply with the requirements of CPCB and MOEF along with specification requirements whichever is stringent.
- 2.05.00 The Bid shall include a detailed discussion on the development status of, and the reasons for any changes made in proposed systems or components for the Plant, as compared with similar items previously supplied in other installations cited by the bidder as reference plants.
- 2.06.00 The Bidder may also make alternate offers, provided such offers are superior in his opinion in which case adequate technical information, operating feed back, etc. are to be enclosed with the offer, to enable the Owner to assess the superiority and reliability of the alternatives offered. In case of each alternative offer, its implications on the performance, guaranteed efficiency, auxiliary power consumptions, etc. shall be clearly brought out to the Owner to make an overall assessment. In any case, the base offer shall necessarily be in line with the specifications i.e. Base offer shall be as per the technical specifications and the same will be considered for techno-commercial evaluation.
- 3.00.00 **NAME PLATES (RATING PLATES)**
- 3.01.00 Instruction plates, name plates or labels shall be permanently attached to each main and auxiliary item of plant in a conspicuous position. These plates shall be engraved with the identifying name, type and manufacturers serial number, together with the loading conditions under which the item of plant has been designed to operate.
- 3.02.00 Items such as valves, etc. which are subject to hand operation, shall be provided with nameplates so constructed as to remain clearly legible throughout the life of the plant giving due consideration to the difficult climatic conditions to be encountered. Nameplates shall be securely mounted where they will not be obscured in service by insulation, cladding, actuators or other equipment. Direction of flow is also to be engraved.
- 3.03.00 All trade nameplates and labels shall be in English language. All measurements shall be in M.K.S. Units.
- 3.04.00 The size and location of nameplates shall be subject to Approval of the Engineer.



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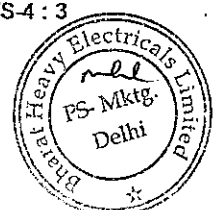
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4.00.00 SAFETY AND SECURITY

- 4.01.00 The design shall incorporate every reasonable precaution and provision for the safety of all personnel and for the safety and security of all persons and property. The design shall comply with all appropriate statutory regulations relating to safety. All structures and equipment shall be designed and constructed to withstand every foreseeable static and dynamic loading condition, including loading under earthquake conditions, with an adequate margin of safety.
- 4.02.00 Ready and safe access with clear head room shall be provided to all parts of the plant for operation, inspection, cleaning and maintenance.
- 4.03.00 Escape routes and clear ways shall be provided to allow speedy evacuation of the plant in the event of fire or explosion, and the plant layout shall allow for ease of access to all parts of the Works by rescue and fire fighting teams. The plant layout shall be designed to localise and minimise the effects of any fire or explosion. The recommendations of NFPA, OSHA, and TAC etc. as necessary shall be followed in all respects.
- 4.04.00 The use of corrosive, explosive, toxic or otherwise hazardous materials shall be kept to a minimum during construction and the design of the plant shall minimise the requirement for such materials during operation and maintenance. Where such materials must be used, all necessary precautions shall be taken in the design, manufacture and layout of equipment to minimise the resulting hazard, and all equipment necessary for the protection and first-aid treatment of personnel in the event of accidents shall be provided. Particular attention is drawn to avoid the use of materials containing asbestos in any form.

5.00.00 GUARDS

- 5.01.00 Effective guards and fences must be provided to prevent injury to operators through accident or malpractice.
- 5.02.00 Mesh guards which allow visual inspection of equipment with the guard in place are generally preferable. The guards shall be constructed of mesh attached to a rigid framework of mild steel rod, tube, or angle and the whole galvanised to prevent loss of strength by rusting or corrosion. The guards shall be designed to facilitate removal and replacement during maintenance.
- 5.03.00 All drive belts, couplings, gears, sharp metallic edges and chains must be safely guarded. Any lubricating nipple requiring attention during normal running must be positioned where they can be reached without moving the guards.
- 5.04.00 Guards for couplings and rotating shafts shall be in accordance with BS 5304-1975 or similar approved standard. All rotating shafts and parts of shafts must be covered.
- 5.05.00 Suitable fencing shall be provided to enclose all openings or doorways used for the hoisting and lowering of machinery etc. This fencing must be securely fixed but quickly detachable when required. A secure hand hold must be provided on each side of the opening or doorway.



6.00.00 LOCATION AND LAYOUT REQUIREMENTS

The majority of plant and equipment (excluding steam generator and some other auxiliaries) shall all be of indoor installation. A broad list of buildings housing such equipment is given elsewhere in this specification. Layout should facilitate access for operation-maintenance and inspection of any one or more equipment/components at a time without disturbing the operation or installation of rest of the plant. Further, Bidder should comply with the criteria given under the various equipment and system specifications as well as those stipulated in Annexure-II attached to this section.

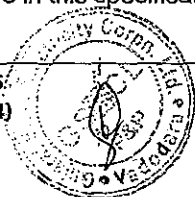
Enclosed General Layout and other tender layout drawings show the location of major installations and auxiliary buildings. The Bidder shall try to retain these locations as far as practicable. The layout of equipment within the power house as shown in the tender drawings is indicative. The Bidder may, subject to Owner's approval alter the same to suit the space requirement of the equipment offered.

Bidder may give as an alternative his own preferred layout clearly indicating the advantages and other implications, if any. Such alternative will not be considered for evaluating the bid, but may be considered with the successful Bidder if Owner/Engineer finds the proposal more attractive in terms of techno-economic consideration.

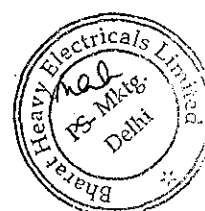
While developing the layout of buildings the following criteria shall be given effect :

- a) The minimum width of clear access corridors around equipment shall be one (1) meter.
- b) Each building shall have an identified vacant space for equipment unloading and maintenance and preferably a separate bay altogether in buildings housing heavy equipment. Provision for handling equipment by monorail hoist and/or overhead crane shall be made as specified.
- c) The minimum clear height available between two consecutive floor slabs shall not be less than five (5) meters. A clear head room of two (2) meters shall be maintained between the floor and any overhead piping/cables or other obstruction. Adequate provision for natural ventilation and illumination shall be made as per good engineering practices.
- d) There shall be at least two (2) nos. main access doors, one on either side of each building, of which one shall be minimum 3 meters wide with rolling shutters for equipment entry. For multistoried buildings, at least two (2) nos. regular staircases diagonally opposite to each other shall be provided connecting all the floors and roof. These minimum requirements shall be augmented as required depending on the floor area, statutory requirements and TAC recommendations.
- e) All buildings shall have provision for toilet and associated effluent discharge system together with facility for drinking water. The criteria for ventilation, fire protection and illumination of building spaces specified elsewhere in this specification shall be complied with.

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- f) All rail/road crossings for pipe/cable racks shall be done with minimum 7 meters clear headroom. Similarly top cover over underground pipes/cables shall be minimum one (1) meter. For other detail refer to Annexure-II.
- g) Cubicle for operating personnel shall be located at safe place near the equipment.
- h) All underground cables in the plant shall be placed in covered reinforced concrete cable trenches. Pipes shall in general be routed above ground and on pedestals, and at road crossings, pipe racks shall be provided. Cable racks / pipe racks shall have hand railings in walkways on both sides at appropriate heights.
- i) Concept of various mechanical and electrical equipment location and building dimensions as shown in Plot Plan/Floor Plan drawing are to be adhered to.

However, size of buildings & facilities as stated above, shall be finalized by EPC Contractor considering the basic design criteria of layout as indicated in the specification.

7.00.00 OPERATION, MAINTENANCE & AVAILABILITY CONSIDERATIONS

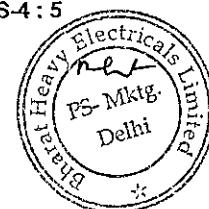
7.01.00 Equipment/works offered shall be designed for high availability, high reliability, low maintenance and ease of operation & maintenance. The Bidder shall specifically state the design features incorporated to achieve high degree of reliability, availability, operability and ease of maintenance. He shall also furnish details of availability records in plants stated in his experience list.

7.02.00 Ample space for ease of operation and maintenance including equipment removal, tube bundle/cartridge/rotor pulling etc. shall be provided. All valves, gates, dampers and other devices shall be located and oriented in such a way that they are accessible from operating floor levels. Where this cannot be adhered to, platforms and walkways with access ladders shall be provided to facilitate operation and maintenance.

7.03.0 Motorised lifting devices, i.e. hoists, chain pulleys, jacks, etc. shall be provided for handling and carrying out maintenance of any equipment and/or part having weight in excess of 3000 Kg. Suitable beams, hooks etc. for this purpose shall be provided in the buildings.

No lifting arrangement is necessary for part having weight less than 500 Kg. Hoist shall be well protected by environment. Suitable painting and coating covering hoist at outdoor shall be provided.

Lifting devices like lifting tackles, slings, etc. to be connected to hook of the hoist/crane shall be provided by the Bidder for lifting the equipment, accessories covered under this specification.



7.04.00 All similar parts of the equipment shall be made to gauge and shall be interchangeable with and shall be made of same material and workmanship as the corresponding parts of the equipment. Where feasible common components shall be employed in different pieces of equipment in order to optimize the spares inventory and utilization.

8.00.00 **MATERIALS**

8.01.00 In selecting materials of construction of equipment, the Contractor shall pay particular attention to the atmospheric conditions existing at the Site and the nature of material/fluid handled. Wherever deviations are taken in respect of materials specified, the reasons shall be spelt out clearly in the proposal.

All materials shall be new, and shall be of the quality most suited to the proposed application.

8.02.00 In as far as is possible; materials shall be in accordance with Indian or international standard specifications and shall be used in accordance with Indian or international codes of practice. Where such standards or codes of practice are not available sufficient information shall be provided to allow the Engineer to assess the suitability of the material for the particular application.

All materials used shall have performed lengthy satisfactory service in similar or more arduous conditions to those proposed by the Contractor.

8.03.00 All parts which could deteriorate or corrode under the influence of the atmospheric, meteorological or soil conditions at the Site, or under the influence of the working conditions shall be suitably and effectively protected so that such deterioration or corrosion is a minimum over the life of the plant.

9.00.00 **LUBRICATION**

9.01.00 Provision shall be made for suitable efficient lubrication where necessary to ensure smooth operation free from undue wear.

9.02.00 Non ferrous capillary tubing shall be used throughout.

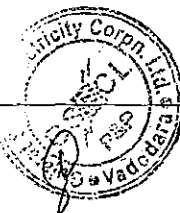
9.03.00 Gear boxes and oil baths shall be provided with filling and drain plugs, both of adequate size. An approved means of oil indication including level switches and temperature indication shall be provided.

9.04.00 All high speed gears shall be oil bath lubricated. Low speed gears shall be lubricated by means of soft grease. Removable and accessible drip pans shall be provided to collect lubricant which may drop from operating parts.

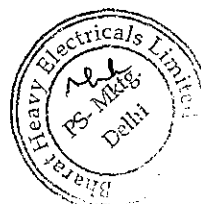
9.05.00 All lubrication points shall be conveniently situated for maintenance purposes. It must be possible to carry out lubrication from a gangway or landing and without the removal of guarding or having to insert the hand into it. Where accessibility to a bearing for oiling purposes would be difficult a method of remote lubrication shall be fitted.

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9.06.00 The Contractor shall supply grease gun equipment suitable to service each type of nipple fitted.

10.00.00 **LUBRICANTS AND CONTROL FLUIDS**

10.01.00 The Contractor shall provide a detailed and comprehensive specification for all lubricating oils, greases and control fluids required for the entire plant. A sufficient supply of these shall be provided by the Contractor for initial commissioning, first fill and till COD of respective units.

10.02.00 The Contractor shall supply a detailed schedule giving the lubricant testing, cleaning and replacement procedures. All equipment and facilities necessary for the testing, cleaning and changing of lubricants and control fluids shall be provided. The Contractor shall endeavor to reduce the varieties and grades of required lubricants and control fluids to a minimum, matching them where possible to those already in use in the generating station in order to simplify procurement and minimise storage requirements. All lubricants and control fluids shall be of internationally recognised standards and shall be easily obtainable from a large number of Indian suppliers. Bidder shall also indicate the equivalent Indian Standard for the above for easy procurement in future.

10.03.00 No lubricant or control fluid shall have toxic or other harmful effects on personnel or on the environment.

11.00.00 **OPERATION AND MAINTENANCE**

11.01.00 The plant shall be designed and constructed so that operation and maintenance manpower requirements are minimised.

The design and layout shall facilitate inspection, cleaning, maintenance and repair. The importance of continuity of operation is second only to that of safety.

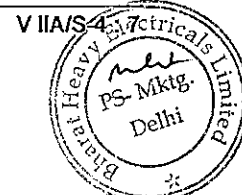
11.02.00 Spare parts for equipment shall be interchangeable with the original components and, so far as possible, be of common design and manufacture.

11.03.00 All similar standard components/parts of similar standard equipment provided shall be interchangeable with one another. Further identical equipments shall be provided for similar duties so that the same are interchangeable with one another in totality and component wise.

11.04.00 All heavy parts (500 Kg and above) must be provided with a convenient arrangement for slinging and handling during erection and overhaul. Any item of plant normally stripped or lifted during periods of maintenance and weighing one tonne or above, shall be clearly marked with its weight.

11.05.00 On completion of commissioning, a complete set of tools for the maintenance of the entire plant shall be provided by the Contractor. This shall include all necessary spanners, special wrenches, extraction equipment and any special tools reasonably required by the Engineer. Tools used during erection and commissioning shall not be accepted except with the specific approval of the Engineer.

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11.06.00 All equipment and major valves should be provided with adequate maintenance approach and facility.

12.00.00 **PLANT LIFE AND MODE OF OPERATION**

The complete plant including all the equipment and systems individually and collectively shall be designed for continuous operation for an economic service life of thirty (30) years under the prevailing site conditions and for the type of duty intended.

The critical components of the Steam Generator, Turbine-Generator and Auxiliary equipment, the life of which is limited by time and temperature dependent mechanisms such as thermal stress, creep and low cycle fatigue, are to be designed considering expected (hot, warm and cold) start-up, shut-down and cyclic load variations.

The allowable stresses shall be reduced so that life expectancy to minimum 2,00,000 hours of operation can be achieved. The Bidder shall discuss this aspect in his technical proposal.

The unit would be operated on base load with cyclic load variation. The load variation is expected to be as per schedule depending on power demand.

The expected start-ups should be considered as minimum
(Based on HPT metal temperature)

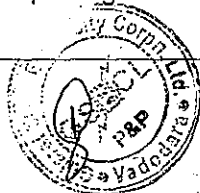
Cold start-up (>50 hrs. shutdown)	:	20 per year
Warm start-up (between 10 to 50 hrs. of shutdown)	:	40 per year
Hot start-up (less than 10 hrs. shutdown)	:	180 per year

13.00.00 **PACKAGING & MARKING**

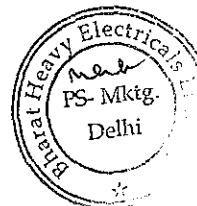
All the equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. While packing all the materials, the limitations from the point of view of availability of railway wagon sizes in India should be taken account of. The details of various wagons normally available with Indian Railways for transportation of heavy equipment shall be considered by the Bidder. The Contractor shall be responsible for all loss or damage during transportation, handling and storage due to improper packing.

As per the information available, the dimensions of OD consignment for transportation of the equipment by rail (if any equipment to be handled through rail transportation) are as below :

- | | | | |
|----|---|---|-------------|
| a) | Width of the Package
(from centre-line of rails
- 1.6 metres on both sides) | : | 3.2 Meters |
| b) | Height of the package from rail top | : | 4.47 Meters |



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The above indicates the dimensions which can be normally transported on the wagons without infringement of the "moving gauge". This is however not indicative of the consignment which can be carried out with infringement of "moving gauge" duly authorised and approved by the Indian Railways. There may be difference between the "moving gauge" and the "fixed structure gauge" and consignments infringing the "moving gauge" can be moved after investigation regarding possible infringement with the fixed structures. As the critical fixed structures in each route are different, consignments infringing moving dimensions have to be individually investigated to select a route and also determine the restrictions under which such movement is to be carried out. Such routes selected or other mode of transport envisaged is to be clearly brought out in the proposal wherever transport of over dimensional equipment is involved.

Bidder to consider unloading of material delivered through rail transportation, at near by railway station/site unloading siding. The subsequent transportation up to project work place shall be considered by road only. All unloading and handling equipment both at railway station siding and at project site shall be arranged by the Bidder. Necessary arrangement to be organized with the railway authority for such purpose shall also be under the scope of services if the Bidder. Bidder may consider entire material delivered up to site through rail transportation only.

The identification marking indicating the name and address of the consignee shall be clearly marked in indelible ink on two opposite sides and top of each of the packages. In addition the Contractor shall include in the marking gross and net weight, outer dimension and cubic measurement. Each package shall be accompanied by a packing note (in weather proof paper) quoting specifically the name of the Contractor, the number and date of contract and names of the office placing the contract, nomenclature of contents and Bill of Material.

For imported equipment and material, suitable port facilities may be used in which case material may be transported from the port by tractor-trailer. Bidder may consider this aspect.

14.00.00 PROTECTION

Equipment having antifriction or sleeve bearings shall be protected by weather-tight enclosures. Coated surfaces shall be protected against impact, abrasion, discoloration and other damages. Surfaces that are damaged shall be repainted.

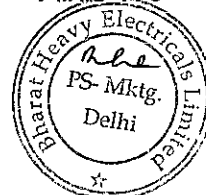
Electrical equipment, controls and insulations shall be protected against moisture and water damages. All external gasket surfaces and flange faces, couplings, rotating equipment shafts, bearings and like items shall be thoroughly cleaned and coated with rust preventive compound as specified above and protected with suitable wood, metal or other substantial type covering to ensure their full protection. All exposed threaded parts shall be greased and protected with metallic or other substantial type protectors.

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All piping, tubing and conduit connections on equipment and other equipment openings shall be closed with rough usage covers or plugs. Female threaded openings shall be closed with rough usage covers or forged steel plugs. The closures shall be taped to seal the interior of the equipment. Open ends of piping, tubing and conduit shall be sealed and taped.

Returnable containers and special shipping devices shall be returned by the manufacturer's field representative at the Contractor's expense.

15.00.00 **PAINTING**

15.01.00 **General**

All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. Surfaces not easily accessible after shop assembly shall be treated before-hand and protected for life of the equipment. Surfaces to be finish painted after installation shall be shop painted with at least two (2) coats of primer. Steel surfaces, which are not to be painted, shall be coated with suitable rust preventive compound subject to the approval of the Owner.

All paints shall be used in accordance with the manufacturer's instructions. No thinners or other substance shall be added to the coating material without the approval of the Engineer. The quality and vendor of the paints shall require approval of the Owner.

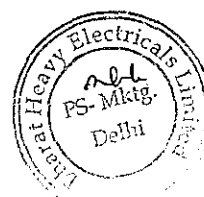
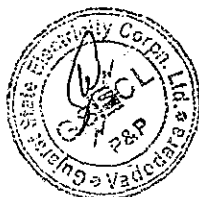
All paints, when applied in a normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects.

All primers shall be well marked into the surface, particularly in areas where pitting is evident, and the first priming coat shall be applied as soon as possible after cleaning, within four hours maximum. The paint shall be applied by brush, roller or airless spray, according to the manufacturer's instructions. Spray painting shall be carried out by operators trained and thoroughly experienced in the use of the equipment. If the drying interval between successive coats, which should not exceed one week, has been so long as to endanger the adhesion of the following coat, the paint already applied shall be lightly rubbed down with fine abrasive paper before putting on the next coat.

Paint spraying on large surfaces shall not normally be done indoors, except with the approval of the Engineer. Spray guns shall not be used outdoors in windy weather or near unprotected surfaces of a contrasting colour and under no circumstances shall spray guns be used where spray may be carried into or onto exposed electrical equipment.

Paint containers shall not be opened until required and the paint shall be mechanically mixed thoroughly before use, and agitated occasionally during use.

Electrical equipment shall be shop finished with one or more coats of primer and two coats of high-grade oil resistant enamel. The interior of all panels' cabinets and enclosures shall be finished with gloss white enamel.



The Contractor shall furnish sufficient touch-up paint for one complete finish coat on all exterior factory surfaces of each item of equipment. The touch-up paint shall be of the same type and colour as the factory applied paint and shall be carefully packed to avoid damage during shipment. Complete painting instructions shall be furnished.

Shop primer for steel and iron surfaces which will have a continuous operating temperature below 35 Deg.C shall be selected by the Contractor, in accordance to the relevant standard. Special high temperature primer shall be used on surface exposed to operating temperature above 35 Deg.C.

The colour scheme shall be submitted during execution of contract for approval by the Purchaser/Engineer.

15.02.00 **Preparation**

Oil and grease shall be removed from the surface by washing with a suitable detergent, rinsing with clean water, and drying.

Surfaces to be shot blasted shall be cleaned to Swedish Standard SA 2.5 or equivalent, and all dust remaining after cleaning shall be removed.

The priming coat shall be applied without delay.

15.03.00 **Damaged Paintwork**

Any damaged paintwork shall be made good as follows :

- a) The damaged area, together with an area extending 25mm around its boundary, shall be cleaned down to bare metal.
- b) A priming coat shall be immediately applied, followed by a full paint finish equal to that originally applied and extending 50mm around the perimeter of the original damage.
- c) The repainted surface shall present a smooth surface. This shall be obtained by carefully chamfering the paint edges before and after priming.

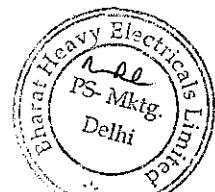
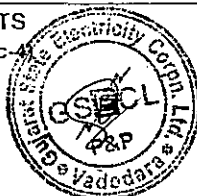
15.04.00 **Painting Systems**

The requirements for the dry film thickness (DFT) of paint and the materials to be used shall be as stated below, unless otherwise specified elsewhere in this specification.

a) **Surfaces Subject To Weathering**

All surfaces shall have a minimum of four coats of paint made up as follows :

Primer coat	:	35 micron DFT
Tie coat	:	35 micron DFT



Finishing coat (2 Nos.) : 35 micron DFT per coat

The total minimum DFT shall be 140 micron.

b) Surfaces Inside Buildings

All surfaces shall have a minimum of three coats of paint made up as follows:

Primer coat : 35 micron DFT

Tie coat : 35 micron DFT

Finishing coat (2 Nos.) : 25 micron DFT per coat

The total minimum DFT shall be 120 micron.

The type and colour of primer & finish coat shall be selected by the Contractor after approval by the Owner.

For detail painting on building & structural steel elements refer Section-IIG/1 & IIG/2 of this specification.

16.00.00 COLOUR CO-ORDINATION & FINISH

16.01.00 Exterior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and with the surrounding landscape.

16.02.00 Interior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and which will be conducive to; the comfort, well-being and high productivity of the operators. Operating plant and services provided shall be colour coded for ease of identification.

16.03.00 All finishes shall be durable and as far as possible maintenance free. Finishes shall be easily cleaned.

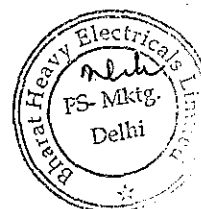
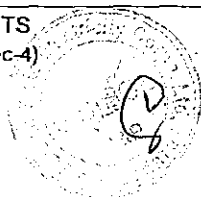
16.04.00 Final colours and finishes shall be to the Approval of the Engineer.

17.00.00 ENVIRONMENT PROTECTION AND NOISE LEVEL REQUIREMENT

17.01.00 Environment Protection

The plant shall be designed for installation and operation in harmony with the surrounding environment and all measures of pollution control shall be ensured by the Bidder to restrict pollution from the liquid effluent and stack emission within the limits as given below with due consideration of Environment (Protection) Rules 1986 as amended till date.

In case the Ministry of Environment & Forest stipulate any other conditions not specified hereunder while clearing the project shall be complied with the plant by the contractor.



17.01.01 For Liquid Effluent

- a) Provision laid down in schedule-I for Thermal Power Plants and also in Schedule-VI. General Standards for discharge of Environmental pollutants Part-A : Effects of Environmental (protection) Rules 1986, as amended till date.
- b) Any specific requirement of State Pollution Authorities over and above the above stipulation.

17.01.02 For Air Emission

- a) Suspended Particulate Matter i.e. dust burden at chimney outlet - Maximum 50 mg/Nm³ (with worst coal and one field out).
- b) NO_x - 365 ppm Max. or 750 mg/Nm³ (Equivalent NO₂).
- c) SO₂ - Concentration based standard 2000 mg/Nm³ Load based standard 0.2 metric tonne /MWe/day (for first 500 MW and 0.1 metric tonne/MWe/day for rest of the capacity above 500 MW)

NO_x and SO₂ limitations are based on the World Bank Norms.

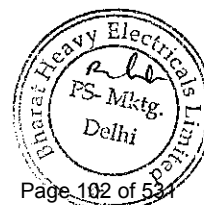
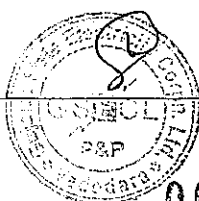
In absence of Indian Standard for emission from power plants as on date, for certain gaseous effluents, the internationally accepted World Bank Standard is to be followed. Indian Standard for emission of power plants are under formulation. Should this standard is published before finalisation of the contract, the bidder has to comply the more stringent of the above norm or the new Indian Standard.

The bidder shall include in his scope all necessary equipment and measuring instruments to comply with above requirements. Location and accessibility of the instruments shall be properly coordinated.

17.02.00 Noise Level Requirement

The plant will be designed, constructed and provided with suitable acoustic measures to ensure the noise level criteria as per the following stipulations.

- a) Maximum noise level shall not exceed 85 dB (A) when measured at 1.0M away from the noise emission source.
- b) Maximum noise level from its source within the premises shall not exceed 70 dB (A) as per Environment (Protection) Rules 1986, Schedule-III, 'Ambient Air Quality Standards' in respect of noise.
- c) Any statutory changes in stipulations regarding noise limitation that may occur in future according to State Pollution Control Board or Central pollution Control Board or Ministry of Environment & Forest regulation during tenure of the contract, the contractor shall comply with the requirement.



An exception will be made for the plant at startup operations and other big pressure reducing devices operating during emergency periods and for the safety valves.

18.00.00 INSPECTION AND TESTING

18.01.00 Inspection and Tests during Manufacture

18.01.01 The method and techniques to be used by the Contractor for the control of quality during manufacture of all plant and equipment shall be agreed with the Owner prior to the Award of Contract.

18.01.02 The Owner's general requirements with respect to quality control and the required shop tests are set out elsewhere in this specification.

18.01.03 Before any item of plant or equipment leaves its place of manufacture the Owner shall be given the option of witnessing inspections and tests for compliance with the specification and related standards.

18.01.04 Advance notice shall be given to the Owner as agreed in the Contract, prior to the stage of manufacture being reached, and the piece of plant must be held at this stage until the Owner has inspected the piece, or has advised in writing that inspection is waived. If having consulted the Owner and given reasonable notice in writing of the date on which the piece of plant will be available for inspection, the Owner does not attend the Contractor may proceed with manufacture having forwarded to the Owner duly certified copies of his own inspection and test results.

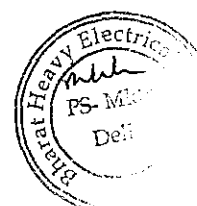
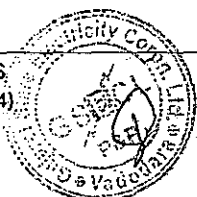
The Contractor shall forthwith forward to the engineer duly certified copies of the Test Certificates in six copies (one to the Purchaser and five to the Consulting Engineer) for approval. Distribution of six (6) copies of Test Certificates for approval will be two(2) copies to owner and four(4) copies to consultant. These four(4) copies will be further distributed by consultant after approval to owner, site and bidder. One copy will be retained with the consultant for record purpose.

Further, nine (9) copies of Shop Test Certificates shall be bound with Instruction Manuals referred to elsewhere. Distribution of nine (9) copies of Shop Test Certificates for approval will be Two (2) copies to owner, Three (3) copies to site, Two (2) copies to consultant, Two (2) copies to owner's library / record.

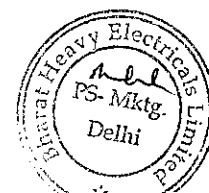
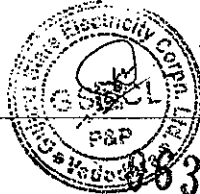
18.01.05 Under no circumstances any repair or welding of castings be carried out without the consent of the Engineer. Proof of the effectiveness of each repair by radiographic and/or other non-destructive testing technique, shall be provided to the Engineer.

18.01.06 All the individual and assembled rotating parts shall be statically and dynamically balanced in the works.

Where accurate alignment is necessary for component parts of machinery normally assembled on site, the Contractor shall allow for trial assembly prior to despatch from place of manufacture.



- 18.01.07 All materials used for the manufacture of equipment covered under this specification shall be of tested quality. Relevant test certificates shall be made available to the Purchaser as per Owner's approved QAP. The certificates shall include tests for mechanical properties and chemical analysis of representative material.
- 18.01.08 All pressure parts connected to pumping main shall be subjected to hydraulic testing at a pressure of 150% of shut-off head for a period not less than one hour. Other parts shall be tested for one and half times the maximum operating pressure, for a period not less than one hour.
- 18.01.09 All necessary non-destructive examinations shall be performed to meet the applicable code requirements.
- 18.01.10 All welding procedures adopted for performing welding work shall be qualified in accordance with the requirements of Section-IX of ASME code or IBR as applicable. All welded joints for pressure parts shall be tested by liquid penetrant examination according to the method outlined in ASME Boiler and Pressure Vessel code. Radiography, magnetic particle examination magnuflux and ultrasonic testing shall be employed wherever necessary/ recommended by the applicable code. At least 10% of all major butt welding joints shall be radiographed.
- 18.01.11 Statutory payments in respect of IBR approvals including inspection for design and manufacturer of equipment shall be made by the Bidder. All payment for erection and testing at site (i.e. under IBR jurisdiction) shall also be made by the Bidder. In such case Contractor's scope shall also be extended to preparation of all necessary documents, co-ordination and follow-up with IBR authorities for above approval.
- 18.02.00 **Performance Tests at Site**
- 18.02.01 The full requirements for testing the system shall be agreed between the Owner and the Bidder prior to Award of Contract. The completely erected System shall be tested by the Contractor on site under normal operating conditions. The Contractor shall also ensure the correct performance of the System under abnormal conditions, i.e. the correct working of the various emergency and safety devices, interlocks, etc.
- 18.02.02 The Bidder shall provide complete details of his normal procedures for testing, for the quality of erection and for the performance of the erected plant. These tests shall include site pressure test on all erected pipe work to demonstrate the quality of the piping and the adequacy of joints made at site.
- 18.02.03 The Contractor shall furnish the quality procedures to be adopted for assuring quality from the receipt of material at site, during storage, erection, pre-commissioning to tests on completion and commissioning of the complete system/equipment.
- 18.03.00 For details of specific tests required on individual equipment refers to respective section of this specification.



19.00.00 TRAINING OF OWNER'S PERSONNEL

The Contractor shall extend all possible assistance and co-operation to the Purchaser regarding the transfer of technology and developing expertise in the area of engineering operation and maintenance of the Plant.

Number of man-days of training as mentioned below shall be included in his Tender.

19.01.00 Training at Contractor's Premises

The Contractor shall conduct training of sixty (60) engineers of the Owner on engineering, operation and maintenance of the Plant at the Contractor's or Associates or Sub-contractor's premises where adequate training facilities are available during the design and manufacturing stage of the Contractor.

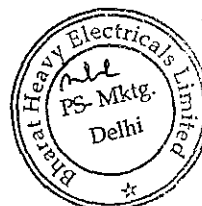
The total man-months for training of engineers shall be maximum sixty (60), having following indicative break-up :

Discipline	No. of Engineers	No. of Man-month
Operation	20 heads	20
Maintenance Boiler, Turbine, Mechanical	20 heads	20
Electrical Maintenance	8 heads	4
Control & Instrumentation	8 heads	4
Maintenance Planning	4 heads	2
	<u>60 heads</u>	<u>60</u>

However, the details of the training programme will be discussed and finalised with the successful Bidder.

The training may also be arranged by the Contractor in any Plant where the equipment manufactured by the Contractor or his Associates is under installation, operation or testing to enable the trainees to become familiar with the equipment being furnished by the Contractor. All expenses inherently related to the training shall be borne by the Contractor and shall include but not limited to travel expenses (international and inland fares), lodging and per diem charges as well as medical insurance, instructors fee, programme and miscellaneous cost to be incurred during the training.

The training programme shall be adequate for the trainees to acquire the necessary expertise and competence in the area of engineering, operation and maintenance and as trainers for in-house technology transfer programme of the Purchaser.



The Contractor shall be responsible for the development of the Training Module and Programme Schedule which shall be submitted to the Purchaser for approval.

The components of the training modules shall include but not be limited to the training procedures/methodology, instructional materials such as audio visual materials, CDs and slides and manuals for each trainee.

Three (3) sets of the materials included in the training modules shall be handed over to the Purchaser upon completion of the training. An evaluation shall be jointly undertaken by the Contractor and the Purchaser's representative on the adequacy, appropriateness and relevance of the training and the programme effectiveness after the training. The training material shall be in English language only.

The content of the training programme shall include but not be limited to :

1. Coal fired thermal plant principles in management and practice for operators, technicians and maintenance personnel.
2. Plant operation and systems training for operators including simulator training as applicable.
3. Maintenance training programme covering electrical, mechanical and instrumentation and control.

Said training programme shall be submitted to the Purchaser for approval.

The timing of the training should be such that the participants will be conversant with sufficient know-how to participate in the pre-commissioning and commissioning tests of the Plant.

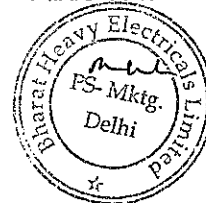
The Contractor shall provide qualified English speaking instructors and training coordinator(s) during the tenure of the training programme.

19.02.00 Operation and Maintenance Training at Site

The Contractor shall provide a comprehensive training programme related to design application, plant management, operation and maintenance, including trouble shooting, of the Contractor's supplied system and equipment at the Site starting from Start of Commissioning and thereafter up to the Final Acceptance of the first Unit.

The following instructors shall be at the Site continuously during the training :

- a) One (1) for Steam Generator and Auxiliaries ;
- b) One (1) for Turbine Generator and Auxiliaries ;
- c) One (1) for Electrical Works ;
- d) One (1) for Instrumentation and Control (Boiler and Auxiliaries) ;
- e) One (1) for Instrumentation and Control (Turbine and Auxiliaries).



19.03.00 **On-the-Job Training**

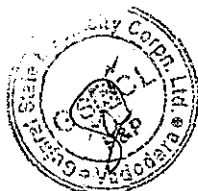
During the period of pre-commissioning, commissioning and trial operation, the Purchaser shall provide operation and maintenance personnel to assist the Contractor in the operation and maintenance of his supply and work under the direction of the Contractor for the purpose of on-the-job training.

The Purchaser shall have the right to send to the Site his employees later intended to operate and maintain the equipment supplied under this Contract. The Contractor shall, without additional cost, use his site staff to instruct these employees on the operation and maintenance of the equipment. All instructions shall be in the English language.

20.00.00 **DEVIATIONS**

The Bidder is required to submit with his proposal in the relevant schedules a detail list of any and all deviations taken by him clearly without any ambiguity. In the absence of such a list it will be understood and agreed that the Bidder's proposal is based on strict conformance to this specification and no post-contract negotiations would be allowed in this regard.

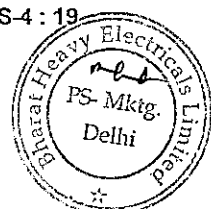
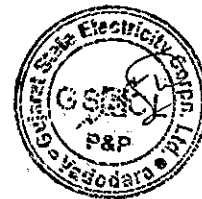
Unless otherwise specifically indicated in the deviation list, it will be construed and agreed that details indicated in documents & drawings furnished by the Bidder along with the offer is in-line with the specification requirement.



ANNEXURE-I

LIST OF STANDARDS FOR REFERENCE

- a) International Standards Organisation (ISO).
- b) International Electro-technical Commission (IEC).
- c) American Society of Mechanical Engineers (ASME).
- d) American National Standards Institute (ANSI).
- e) American Society for Testing and Materials (ASTM).
- f) American Institute of Steel Construction (AISC).
- g) American Welding Society (AWS).
- h) Architecture Institute of Japan (AIJ).
- i) National Fire Protection Association (NFPA).
- j) National Electrical Manufacturer's Association (NEMA).
- k) Japanese Electro-technical Committee (JEC).
- l) Institute of Electrical and Electronics Engineers (IEEE).
- m) Federal Occupational Safety and Health Regulations (OSHA).
- n) Instrument Society of America (ISA).
- o) National Electric Code (NEC).
- p) Heat Exchanger Institute (HEI).
- q) Tubular Exchanger Manufacturer's Association (TEMA).
- r) Hydraulic Institute (HIS).
- s) International Electro-Technical Commission (IEC) Publications.
- t) Power Test Code for Steam Turbines (PTC).
- u) Applicable German Standards (DIN).
- v) Applicable British Standards (BS).
- w) Applicable Japanese Standards (JIS).
- x) Electric Power Research Institute (EPRI).



- y) Standards of Manufacturer's Standardization Society (MSS).
- z) Bureau of Indian Standards Institution (BIS).
- aa) Indian Electricity Rules.
- bb) Indian Boiler Regulations (IBR).
- cc) Indian Explosives Act.
- dd) Indian Factories Act.
- ee) Tariff Advisory Committee (TAC) rules.
- ff) Emission regulation of Central Pollution Control Board (CPCB).
- gg) Pollution Control regulations of Dept. of Environment, Govt. of India
- hh) Central Board of Irrigation and Power (CBIP) Publications.
- ii) The Air Prevention and Control of Pollution Act.
- jj) The Environmental Protection Act
- kk) The Public Liability Insurance Act.
- ll) The Forest Conservation Act
- mm) The Wildlife protection Act.
- nn) The EIA Notification, 1994.
- oo) IS: 14665-Specification for Electric Traction Lift
- pp) Any other statutory Codes/Standards/Regulations



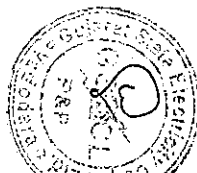
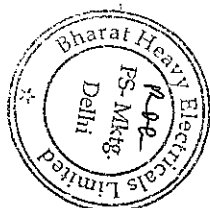
ANNEXURE-II

SCHEDULE OF PERMITS & CLEARANCES

Sl. No.	Clearances	Authority	Responsibility
1.0	STATUTORY CLEARANCES		
1.1	Pollution clearance, water and air [Sec.25 of the Water (Prevention & Control of Pollution) Act, 1974 as amended in 1988, and Sec. 21 of the Air (Prevention & Control of Pollution) Act, 1981 as amended in 1987]	Gujarat State Pollution Control Board	Owner-Consent to establish the project. Contractor - Permission for operation
1.2	Environmental clearance	Ministry of Environment & Forest, Government of India	Owner
1.3	Aviation Clearance	Airport Authority of India, New Delhi.	Owner
2.0	NON-STATUTORY CLEARANCES		
2.1	Land availability at Plant area	Govt. of Gujarat / Private land Owner, if any	Owner
2.2	Land for Transportation of Coal	Govt. of Gujarat / Private Land Owner, if any	Owner
2.3	Transportation of Fuel (Secondary Fuel)	Department of Petroleum and Natural Gas, Ministry of Railways, Shipping and Surface Transport	Owner
2.4	Rights & right to access of all public roads from manufacturer's works to site,	Concerned Authorities	Contractor
3.0	OTHER CLEARANCES/ APPROVALS		
3.1	Approval and Registration of steam generator as per Indian Boiler Regulation	Chief Inspectorate of Boilers	Contractor
3.2	Approval as per Indian Electricity Act and Rules for Electrical Installation	Electrical Inspectorate	Contractor
3.3	Approval as per Indian Petroleum Act and Petroleum Rules for storage of petroleum products.	Chief Controller of Explosives	Contractor
3.4	Approval as per gas cylinder rules and handling and transport of compressed gases	Chief Controller of Explosives	Contractor
3.5	a) Collection, storage and disposal of waste during construction till handing over of the project.	Gujarat State Pollution Control Board	Contractor

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Sl. No.	Clearances	Authority	Responsibility
	b) Site clearances, safe report and safety audit during construction till handing over of the project.	Gujarat State Pollution Control Board	Contractor
3.6	Approval of Fire Protection Scheme	Authorised Agencies approved by Insurance Regulatory Development Authority, New Delhi (IRDA)	Contractor
3.7	Consent for use of the site for the construction and operation of the Power Station and Fuel Facility	Directorate of Town and Planning of Government of Gujarat	Owner
3.8	Consent for the development of Project Site and the Township site	Directorate of Town and Planning of Government of Gujarat	Owner
3.9	Approval of the proposed design and construction of power station	Chief Inspector of Factories of Government of Gujarat	Contractor
3.10	Allocation / approval of electric supply for bulk construction power	Gujarat State Electricity Dept.	Owner
3.11	Carriage entrance to property	Municipal Corporation: Assistant Engineer, Roads or concerned authorities	Contractor
3.12	Approval of building layout with fire safety concerns and receipt of No Objection Certificate	Municipal Corporation: Chief Fire Officer or concerned authorities	Contractor
3.13	No Objection Certificate regarding air & fugitive emissions	Municipal Corporation: Executive Engineer and Gujarat Pollution Control Board	Contractor
3.14	No objection Certificate for Chimney and Registration	Inspector of Smoke Nuisance	Contractor
3.15	No Objection Certificate for sewage water treatment and associated plumbing	Municipal Corporation: Executive Engineer, Sewerage and Planning or concerned authorities	Contractor
3.16	To review the frequency used for Power Line Carrier Communication (PLCC) system to ensure no interference with other power line users	Postal Tele communication Coordination Committee (PTCC)	Owner-PLCC Contractor- Wireless equipment (postal telecommunication)
3.17	No objection certificate for plant layout with regard to electrical equipment, operational safety	Chief Electrical Engineer of Gujarat	Contractor
3.18	No Objection Certificate for storage of construction Materials and chemicals, etc.	Municipal Corporation: Assistant Engineer, Factory Department	Contractor

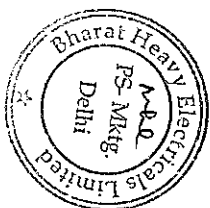
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Sl. No.	Clearances	Authority	Responsibility
3.19	No Objection Certificate for storage of construction fuel oils and chemicals, etc.	Commissioner of Police	Contractor
3.20	No Objection Certificate for storage of Distillate Oil	Chief Controller of Explosives	Contractor
3.21	No Objection Certificate for road opening and asphaltting Work including traffic Work.	Municipal Corporation: Assistant Engineer, Roads or concerned authorities	Contractor
3.22	Local approval for operating the plant	Municipal Corporation: Ward Office or concerned authorities	Not applicable
3.23	Local approval of Architectural plans for township	Municipal Corporation or concerned authorities	Owner
3.24	Consent under the Factories Act, 1948 relating to fire fighting capacities	Directorate of Town and Planning of Government of Gujarat	Contractor
3.25	Clearance of Lifts	Inspector of Lifts, Govt. of Gujarat	Contractor
3.26	Approvals / clearances for labour / man power like License from labour commissioner for Construction labour, Registration of Workers or exemption to be claimed if group insurance taken for some, etc.	Concerned Authorities	Contractor
3.27	Any other clearances	Appropriate Authorities	Contractor
3.28	Export Authorisation (Export license)	Appropriate Authorities of exporting country	Contractor



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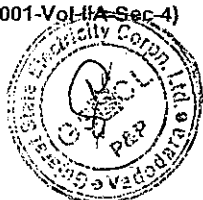
ANNEXURE-III

CRITERIA FOR LAYOUT

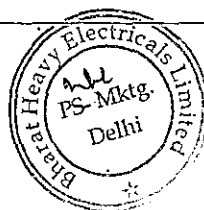
PLOT PLAN LAYOUT REQUIREMENTS

ITEM	SPECIFICATION REQUIREMENT
A. Site conditions to be considered	
1. Prevalent wind direction	See wind-rose in plot plan. Also refer Metrological Data.
B. Layout Requirements	
1. Maximum permissible slope in	
a) Rail track	1 in 400
b) Road	1 in 30
c) Sides of unpaved embankment	1 in 2
2. Required road width	
a) Main roads Refer Vol. II-G.	
b) Auxiliary interconnections Refer Vol. II-G.	
c) Road to the power house unloading bay :	
• Only for entry to the unloading bay	Yes
• To pass through the unloading bay	No
3. Required minimum horizontal distance between the nearest points of	
a) Plant boundary and the boundary of residential area	(Local municipality/factory rule)
b) Electrical transformer and any other	As per the Tariff Advisory building/facility Committee Rules
c) Fire water supply installation and any building/facility subject to fire risk.	As per the Tariff Advisory Committee Rules
d) Inflammable liquid (fuel oil, etc.) storage & handling installation and their fencing and other buildings/facilities.	Rules of the Indian Explosive (Indian Explosives Act) and Indian Petroleum Code

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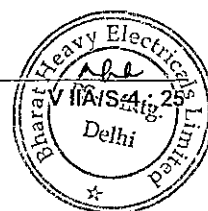
ITEM	SPECIFICATION REQUIREMENT
4. Required minimum vertical clearance	
a) Under pipes/cable racks at road crossings	7.0 Metres
b) Soil coverage over underground pipes	1.0 Metre (minimum)
c) Pipe/Cable trench	Not Acceptable
5. Railway Wagon clearance	Rules of the Indian Railways
6. Minimum Clearance between any road edge and building/structure/ any fixed installation.	3 Metres
7. Required level, above the local developed grade level, of	
a) top of all roads	150 mm
b) all outdoor paved areas	150 mm
c) Temporary storage areas, workshops, offices, residence etc. required at the time of erection work.	Yes
d) Green belt around power plant area	As per environmental guidelines of MOEF, Govt. of India.

BUILDING/ EQUIPMENT LAYOUT REQUIREMENTS

- A. Minimum clear space required at all working and walking areas for operating & maintenance personnel
- Horizontal, in all directions
 - Adjacent to any electrical equipment, electrical cables, running (rotating/reciprocating) equipment, safety valve or vent/drain pipe outlet, pipe/ equipment of surface temperature exceeding 60°C. 1200 mm
 - Adjacent to any other plant facilities (including walls/structures) 1000 mm
 - Vertical (head-room clearance)
 - Under any pipe/equipment surface of temperature exceeding 60°C and any electrical cables or other electrical items. 2.0 Metre
 - Under any other plant facilities (including structures, pipes etc.) 2.0 Metre

DEVELOPMENT CONSULTANTS
(K9213R-EPC-SPC-001-Vol-IIA-Sec-4)

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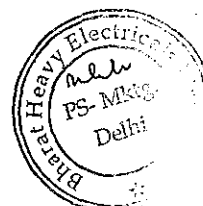


ITEM	SPECIFICATION REQUIREMENT
3. For all areas where any equipment (including trucks, trolleys and other material handling equipment) will move or maneuver.	Minimum 500 mm clear in all direction from the outer edges of the equipment
4. Minimum clear hand space required for	
a) The application of thermal insulation	100 mm
b) Welding work	150 mm
c) Bolt tightening	150 mm
B. Floors, platforms, staircase, ladders, walls, doors & windows	
1. Statutory Requirement	As per the regulations of Tariff Advisory Committee, Indian National Building Code, Indian Factories Act, Local Municipal Rules, etc.
2. Operation & Maintenance Requirement	
a) Adequate floor space shall be kept to permit dismantling, temporary storing and in-situ maintenance of plant & equipment parts, satisfying the clear space requirements stated above. A separate unloading bay for such purpose is required.	Yes
b) Floors or fixed/portable platforms with stairs/ ladders shall be provided for easy approach to any plant item, including valves, instruments, etc. to be operated, observed and/or to be frequently (more than once a month) maintained.	Yes
3. Plinth level of all buildings, above the local developed for power house building.	300 mm, however, 500 mm grade level
4. Minimum access opening required (with rolling shutter) transportation,	3.5M wide x 4M high or, wherever entry of truck, for material more depending upon the is envisaged equipment size to be handled.

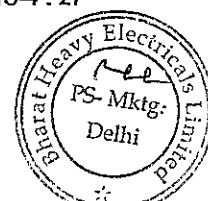
DEVELOPMENT CONSULTANTS
(K9213R-EPC-SPC-001-Vol-IIA-Sec-4)

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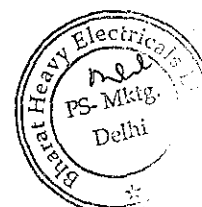
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ITEM	SPECIFICATION REQUIREMENT
C. Other Maintenance Requirement	
1. Generator stator handling In case the Generator stator cannot be handled by the turbine house crane, all provisions for its overhauling, including the arrangement to slide the stator on the turbine house floor, the foundation work for stator jacking /lowering assembly, dismantling of building end walls/structures etc. shall be kept.	Yes
2. Maintenance of the internals/impellers of all important equipment, like boiler feed pumps, feed water heaters, Surface Condenser, fans of the boiler draft plant, Intake and circulating water pumps, cooling water pumps, coal mills, compressors, blowers, heat exchangers, fuel air oil pumps, filters etc.	Shall be possible without disconnecting or dismantling any piping/ducting.
3. Overhauling and handling of the casings for the above items	Shall be possible without disturbing/dismantling any piping/ducting not directly connected to them.
4. Crane Approach Wherever required the unobstructed approach of the crane hook/other hoisting equipment hook to various plant & equipment shall be possible.	Yes
D. Central Control Room All electronic equipment other than those directly associated with control, operation or presentation of displays shall be mounted external to the control room in air conditioned control equipment room. The bidder shall describe in his bid the proposed layout philosophy of the Central Control Room and Control Equipment Room and the arrangement of equipment best suited for the system offered by him and as per good ergonomically consideration. However, as a guide line, following features are given :	Yes
a) False ceiling and false flooring shall be provided.	
b) Uniform height, colouring schemes for cabinets etc. shall be available.	

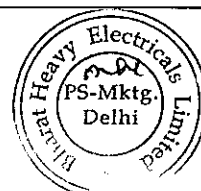
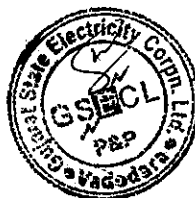


ITEM	SPECIFICATION REQUIREMENT
c)	The total area of floor space covered by Control Consoles/Panels in the Control Room shall not exceed 15% of floor area.
d)	No opening shall be provided from Boiler side.
e)	Two double leaf doors, suitably located for entering the Control room shall be provided with opening towards the turbine floor.
f)	Cable entry for the panels/consoles shall be from bottom and suitable openings shall be provided.
g)	The Control Room lighting shall be designed to provide a glare free uniform illumination. The level of illumination shall be minimum 400 LUX.
h)	Necessary Air Conditioning shall be provided for Central Control room, Control Equipment Room and SWAS room etc.
i)	Basic amenities like toilet, Tiffin rooms, wash basins, rest rooms etc. shall be provided near the Control Room.
E.	Toilet and drinking water facility
	Required in all buildings and on all floors wherever operating personnel are to be deployed.



SECTION-4

SPECIAL CONDITIONS FOR ERECTION AND CONSTRUCTION

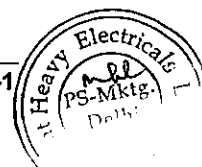
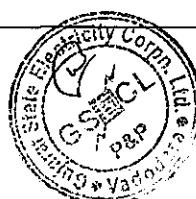


SECTION-4

SPECIAL CONDITIONS FOR
ERECTION AND CONSTRUCTION

C O N T E N T S

SL.NO.	DESCRIPTION	PAGE NO.
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SECTION-4

**SPECIAL CONDITIONS FOR
ERECTION AND CONSTRUCTION**

1.0 GENERAL

The following items shall supplement the conditions in the other Sections of this Volume.

2.0 SCOPE OF WORK

2.1 Erection Work

The Contractor shall prepare erection drawings and obtain approval of the same from the Owner as applicable.

The Contractor shall receive the imported Goods, if any, at the port of entry, clear them through Customs and make damage report through port broker. The Contractor shall arrange for payment at prescribed rate of Customs Duties, if required by the Owner, which will be reimbursed by the Owner against Contractor's valid documents upto the overall amount specified in the price bid and agreed.

The Contractor shall transport all imported Goods & indigenous goods from port of entry, from manufacturer's works to the Site and unload all Goods at the Site. Crane services shall be provided by the Contractor, if necessary. All storage at port of entry or at railway station shall be at Contractor's cost.

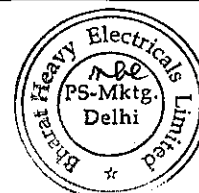
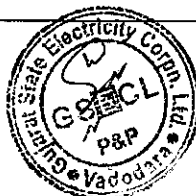
The Contractor shall be responsible for complete installation as per approved drawings, testing, commissioning, trial run of the Plant at the Site and putting the Plant into commercial operation including finish painting work.

All machinery and tools for transportation and erection shall be provided by the Contractor at his cost.

The Goods after receipt at the Site, shall be checked and verified against the shipping documents and all claims made and replacement or repair order against loss or damage in transit shall be intimated to the Owner. The Goods shall remain under the custody of the Contractor until the Plant is taken over by the Owner upon completion of the Work. The Contractor shall take adequate steps to ensure safety and protection of such Goods. Necessary stores receipt certificates shall be issued to the Owner after the Goods are checked and certified.

No Goods pertaining to the Contract shall be removed from the Site without the consent in writing by the Owner.

The Contractor shall be responsible for replacement, free of cost to the Owner, of any material damaged due to improper storage.



The Contractor shall be responsible for setting up correct reference lines for the purpose of fixing alignments of various equipment. The Contractor shall be responsible for replacement, free of cost to the Owner, of any goods damaged/lost/broken down in any point of operation due to any reason whatsoever while under the custody of the Contractor.

The Contractor shall arrange for, at his cost, all consumables, paints, lubricants, etc. as required.

The contractor shall arrange at his own cost for approvals, clearances, registration, inspections etc. from but not limited to Government authorities, statutory authorities, e.g. Factory Inspector, Boiler Inspector, Electrical Inspector, Explosive Inspector, Municipal corporation, ESI authorities, Labour authorities etc. for design, engineering, supply, erection and commissioning etc.

All surplus/unused materials/scrap materials left after completion of project shall become property of Contractor, provided the materials were brought by the Contractor and the payment was not made for the same by Owner.

2.2 Civil, Structural and Architectural Works

The Contractor shall be responsible for the preparation of the design and all drawings and obtain approval of the same from the Owner when required.

The Contractor shall be responsible for the survey and true and proper setting out of the Works and for the correctness of the positions, levels, dimensions and alignments of the all parts of the Works and shall provide all necessary survey grid-pillars, bench-marks, instruments, appliances and labour in connection therewith. If at any time during the progress of the Works any error shall appear or arise in the positions, levels, dimensions or alignments of any part of the Works, the Contractor, on being required to do so by the Owner/Engineer, shall at his own expense rectify such errors to the satisfaction of the Owner/Engineer. The checking of the setting out of any line or level by the Owner/Engineer or the Engineer's representative shall not in any way relieve the Contractor of his responsibility for the corrections thereof. The Contractor shall carefully protect and preserve all survey grid-pillars, bench marks, site rails, pegs and other things used in setting out the Works.

The Contractor shall be responsible for all civil, structural and architectural Works as required for the installation of the Plant and its sub-systems and other facilities.

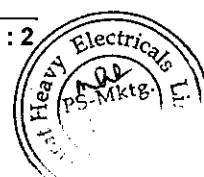
The Contractor shall arrange for supply of all Goods at his cost.

3.0 INSURANCE

In addition to the conditions stipulated in Section-3 of this Volume, the Contractor shall also arrange for insurance coverage as under :

a) Workmen's Compensation Insurance

This insurance shall protect the Contractor against all claims applicable



under the Workmen's Compensation Act (Government of India). This policy shall also cover the Contractor against claims for injury, disability, disease or death of his or his sub-contractor's employees, which for any reason are not covered under the Workmen's Compensation Act. The liabilities shall not be less than :

Workmen's Compensation	:	As per statutory provisions
Employee's liability	:	As per statutory provisions

b) Comprehensive General Liability Insurance

The insurance shall protect the Contractor against all claims arising from injuries, disabilities, disease or death of members of public or damage to property of others due to any act or omission on the part of the Contractor, his agents, his employees, his representatives and sub-contractors from riots, strikes civil commotion and terrorism.

The hazards to be covered will pertain to all the works and areas where the Contractor, his sub-contractor(s), his agents(s) and his employee(s) have to perform work pursuant to the Contract.

The above are only illustrative list of insurance covers normally required and it will be the responsibility of the Contractor to maintain all necessary insurance coverage to the extent both in time and amount to take care of all his liabilities either direct or indirect, in pursuance of the Contract.

4.0

WORK AT SITE

In the execution of the Work, no persons other than the Contractor, or his duly appointed representative, sub-contractor(s) and workmen employed by him and his sub-contractor(s) shall be allowed to do work at the Site, except by the special permission, in writing, of the Owner or his representative. Access to the Work at all times shall be accorded to the Engineer and representatives of the Owner.

The Contractor shall at all times and at his own cost take sufficient precautions to ensure the safety of public and guard the Site deemed necessary.

The Work at Site shall be carried out without interference with Owner's activities.

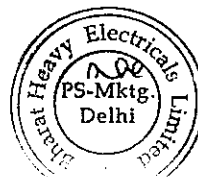
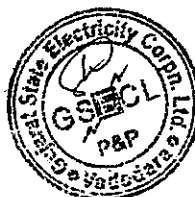
No female labour shall be allowed during dark hours.

The Contractor shall not employ for the purpose of executing the Works, any person who is below the age of eighteen (18) years. The Contractor shall pay to each labourer, for the work done by such labourer, wages, not less than the wages paid for similar work in the district.

5.0

MANUFACTURER'S SUPERVISION

If the Contractor is not the manufacturer, he may be required to work under the guidance of the manufacturer's technical personnel. However, this will not



relieve the Contractor of his responsibility for the correctness of work done or quality of workmanship.

6.0 CONTRACTOR'S REPRESENTATIVE

6.1 The Contractor shall employ the necessary competent representatives at the Site, whose name shall have previously been communicated in writing to the Owner/Engineer by the Contractor to supervise the erection of the Plant. The required representatives shall be present at the Site during working hours, and any written orders or instructions which the Owner/Engineer or his duly authorised representative may give to such representative of the Contractor, shall be deemed to have been given to the Contractor.

6.2 The Contractor's representative employed for the purpose of the work at the Site shall be stationed at the Site when the Owner informs the Contractor in writing to that effect.

7.0 FOREIGN PERSONNEL

The Contractor shall bear all expenses in connection of any foreign personnel he plans to bring into India for the performance of the Works.

If the Contractor requires the assistance of the Owner, to the extent possible, to obtain any necessary travel permits for the foreign personnel, the Contractor shall provide the Owner with all necessary data on such foreign personnel. The Contractor shall allow the Owner a reasonable time prior to the proposed date of departure of the foreign personnel, to enable the Owner to provide the assistance required.

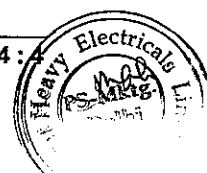
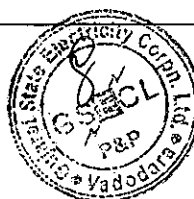
The Owner shall assist the Contractor to the extent possible in obtaining necessary permits to travel to India and back, by issue of necessary certificates and other information needed by the Competent Authorities.

The Contractor and the foreign personnel shall abide by statutory laws, rules & regulations in force in India at the time thereof & shall not in any way interfere with Indian political and/or religious affairs. The Contractor's foreign personnel shall work and live in close co-operation & co-ordination with their co-workers and the community and shall not engage themselves in any other employment either part time or full time nor shall they take part in any local politics.

The Contractor shall pay all taxes due in India for the foreign personnel employed by the Contractor for their work in connection with this Contract. The Contractor shall obtain at his own cost "work permits" required from competent authorities to enable the foreign personnel to work in India.

8.0 PROGRAMME OF WORK AND PROGRESS REPORT

The Contractor shall, as required from time to time, submit to the Owner erection and construction schedules in the form of PERT network or bar chart showing the time-table the Contractor proposes to follow to carry out the work with dates and estimated completion times for various parts (milestones) of the Work. Such schedules shall be approved by the Owner, prior to the



commencement of the Work at the Site.

During the progress of the work, the Contractor shall submit copies of monthly progress reports and photographs and such other reports on the erection and construction Works and his site organisation, as the Owner/Engineer may direct. The format of the progress report shall be decided upon by the Contractor with the approval of the Owner. However, if at any time the Owner desires to change the format or requires any additional information, the Contractor shall comply. The Contractor shall also submit an anticipated one (1) months programme at the beginning of each month describing in detail the anticipated programme for the following month. The Contractor shall also submit from time to time, a list of various categories of his employees. Monthly progress reports shall be submitted by the tenth (10th) day of the month following the reporting month.

9.0 INDEMNITY

The Contractor shall, except if and so far as the Contract provides otherwise, indemnify the Owner against all losses and claims in respect of injuries or damage to any person, material or plant, or damage to any property whatsoever but not limited to third party damages which may arise out of or in consequence of the execution of the Works, and against all claims, proceedings, damages, costs, charges and expenses whatsoever in relation thereto.

10.0 CLEAN UP WORK AT SITE

The Contractor shall without any additional payment at all times keep the working and storage areas used by him and/or his sub-contractor(s) free from accumulation of waste materials or rubbish. If these materials are not removed by the Contractor within forty-eight (48) hours, after being requested by the Owner, these will be removed by others and the cost of the same will be charged to the Contractor. Any inflammable materials shall be removed forthwith on request by the Owner.

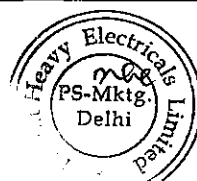
On completion of erection and construction work, the Contractor shall remove or dispose of in a satisfactory manner all temporary structures, packing cases, waste and debris and leave the premises in a condition satisfactory to the Owner. All surplus earth shall be removed beyond the Plant area and dumped in a place(s) as directed by the Owner/Engineer.

11.0 CO-ORDINATION WITH THE OWNER'S ENGINEERS

The Contractor shall at all times work in co-ordination with the Owner's Engineers and afford them every facility to become familiar with the erection and maintenance of the equipment and construction work.

12.0 MATERIALS HANDLING AND STORAGE

The Contractor shall be responsible for examining the shipment and shall notify the Owner immediately of any damage, shortage, discrepancy, etc. for the



purpose of Owner's information only.

The Contractor shall maintain an accurate and exhaustive record detailing of all Goods received by him for the purpose of erection and keep such record open for inspection by the Owner at any time.

All electrical panels, control gear motors and such other devices shall be properly dried by heating before they are installed and energised. Motor bearings, slip rings, commutators and other exposed parts shall be protected against moisture ingress and corrosion during storage and periodically inspected. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion due to prolonged storage.

All the electrical equipment such as motors, generators etc. shall be tested for insulation resistance at least once in three months from the date of receipt till the date of commissioning and a record of such measured insulation values shall be maintained by the Contractor. Such records shall be open for inspection by the Owner/Engineer.

The Contractor shall ensure that all the packing materials and protection devices used for the Goods during transit and storage are removed before the Goods are installed.

The consumables and other supplies which are likely to deteriorate due to storage must be thoroughly protected and stored in a suitable manner to prevent damage or deterioration in quality during the storage period.

All the materials stored in the open or dusty locations must be covered with suitable weatherproof and flameproof covering material wherever applicable.

If the materials belonging to the Contractor are stored in area other than those earmarked for him, the Owner will have the right to have them moved to the area earmarked for the Contractor at the Contractor's cost.

The Contractor shall be responsible for providing suitable covered storage facilities to store all Goods which require covered storage. Normally, all the electrical equipment such as motors, control gear, generators, exciter and consumables like electrodes, lubricants, etc. shall be stored in the covered storage space. In addition, the Owner, may direct the Contractor to move certain other materials which in his opinion will require covered storage and the Contractor shall strictly comply with his instruction.

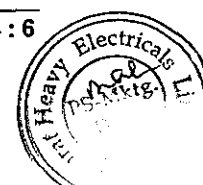
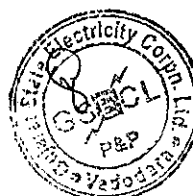
13.0 LABOUR AND LABOUR LAWS

13.1 Recruitment of Local Labour

Local labourers shall be engaged for unskilled work. Preference may also be given for appointment of local labourers in semi-skilled and skilled categories, if such suitable labourers are available.

13.2 Labour Laws and Local Regulations

The Contractor shall abide by the prevailing labour laws and shall have to



obtain a labour license from the appropriate authority as per the law at his cost and shall indemnify the Owner against any financial and other obligation in connection with labourers employed by him. On obtaining the labour license, the Contractor at the appropriate time, shall submit a certified photocopy of the same to the Owner.

13.3 Wages and Working Hours and Conditions

The Contractor shall pay wages and observe hours and conditions of labour not less favourable than those established for the trade or industry in the district where the work is carried out. In the absence of any wages, hours or conditions of labour so established, the Contractor shall pay wages and observe hours and conditions of labour which are not less favourable than the general level of wages and hours and conditions observed by other contractors whose general circumstances in the trade or industry in which he is engaged are similar.

13.4 Contractor to furnish return of labour employed

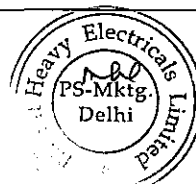
The Contractor shall, if required by the Owner/Engineer, deliver to the Owner/Engineer or to his office a return in such form and at such intervals as the Owner/Engineer may prescribe, showing in detail classes of labour employed and the number employed within each class by the Contractor from time to time on the Site and such information in respect of construction machinery as the Owner/Engineer may require.

13.5 The Contractor shall make his own arrangements for the engagement of all labour and provide on the Site in so far as the Contract otherwise provides, for the transport, housing, feeding and payment thereof.

The Contractor shall, so far as is reasonably practical, having regard to local conditions, provide on the Site, to the satisfaction of the Owner/Engineer an adequate supply of drinking and other water for the use of his staff and labour.

13.6 Other Requirements

- a) The Contractor shall not, other than in accordance with the Statutes, Ordinances and Government Regulation or Orders currently in force, import, sell, give, barter or otherwise dispose of any alcoholic liquor, or drugs, or permit or suffer any such importation, sale, gift, barter or disposal by his sub-contractor(s), agents or employees.
- b) The Contractor shall not give, barter or otherwise dispose of to any person or persons any arms or ammunition of any kind or permit the same as aforesaid.
- c) The Contractor shall in all dealings with labour in his employment have a due regard for all recognised festivals, days of rest and religious or other customs.
- d) In the event of any outbreak of illness of an epidemic nature, the Contractor shall comply with any regulations, orders and requirements as may be made by the Government, or the local municipal or sanitary authorities for the purpose of dealing with and overcoming the same.



- e) The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst his employees.
- f) The Contractor shall be responsible for observance by his sub-contractor(s) of the foregoing provisions.

14.0 PROTECTION AND CARE OF WORKS

14.1 The Contractor shall in connection with the Works provide and maintain at his own cost all temporary works, lights, guards, fencing and watching when and where necessary or required by the Owner/Engineer or by any competent statutory or other authority for the protection of the Works.

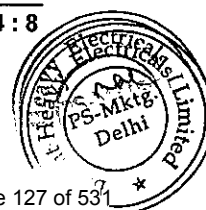
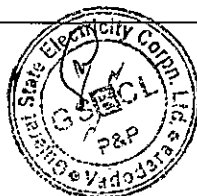
14.2 From the commencement to the completion of the Works, the Contractor shall take full responsibility for the care of the Works and of all temporary works. If any damage, loss or injury happens to the Works or to any part thereof or to any temporary work from any cause whatsoever (save and except the "Force Majeure" as defined earlier) the Contractor shall at his own cost repair and make good the same so that at completion the works shall be in good order and condition and in conformity in every respect with the requirements of the Contract Documents and the Owner/Engineer's written instructions. The Contractor shall also be liable for any damage to the Works caused by him in the course of any operations he carries out for the purpose of complying with his obligations under the Contract Documents.

15.0 OWNERSHIP OF ARTICLES OF VALUE DISCOVERED AT SITE

All fossils, contains, articles of value or antiquity and structures and other remains or things of geological or archaeological interest discovered on the Site shall be deemed to be the absolute property of the Owner. The Contractor shall take reasonable precautions to prevent his workmen or any other persons from removing or damaging the same, and shall immediately, upon discovery thereof and before removal, inform the Owner/Engineer of such discovery and carry out, at the expense of the Owner the Engineer's orders concerning the removal of the same.

16.0 CONVENIENCE OF PUBLIC

All operations necessary for the execution of the Works and for the Construction of any temporary work shall, so far as compliance with the requirements of the Contract permit, be carried on so as not to interfere unnecessarily or improperly with the public convenience of access to use public or private roads and foot paths or to use properties whether in the possession of the Owner or of any other person. The Contractor shall indemnify the Owner in respect of all claims, demands, proceedings, damages, costs, charges and expenses whatsoever in relation to any violation by the Contractor of the above.



17.0 **PREVENTION OF EXTRAORDINARY TRAFFIC AND PROTECTION OF HIGHWAY**

The Contractor shall use reasonable means to prevent the highways or bridges communicating with or on the routes to the Site from being subjected to extraordinary traffic by traffic of the Contractor or any of his sub-contractors. In particular the Contractor shall select routes, choose and use vehicles and restrict and distribute loads, so that any such extraordinary traffic as will inevitably arise shall be limited as far as reasonably possible, and so that no unnecessary damage or injury may be caused to such highways and bridges. If it is found necessary for the Contractor to move over part of highway or bridge, one or more loads, where the moving of such load will in all probability damage the highway or bridge unless means of protection or strengthening are carried out, then the Contractor shall, before moving the load on to such highway or bridge, give notice to the Owner of the weight and other particulars of the load to be moved, and his proposals for protecting or strengthening the said highway or bridge. The Contractor shall also carry out the protection and strengthening of the highway or bridge as required.

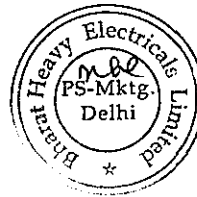
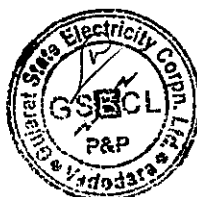
18.0 **WORK MATERIALS AND PLANT**

18.1 **Materials and Workmanship**

All construction materials, structural steel and workmanship shall be of the respective types described in the Contract Documents, and shall be subjected from time to time to such tests as stipulated in the approved quality assurance plan. The Contractor shall establish on site testing facilities as required by him. Collection of samples and testing as specified in the Contract Documents including special tests, if any, shall be carried out by the Contractor at his cost.

18.2 **Examination of the Works**

No work shall be covered up or put out of view without the approval of the Owner/Engineer and the Contractor shall afford full opportunity for the Owner/Engineer to examine and assess any work which is about to be covered up or put out of view, and to examine foundations before permanent work is placed thereon. The Contractor shall give due notice to the Owner/Engineer whenever any such work or foundation is ready for examination. The Contractor shall uncover any part or parts of the Works, make openings in or through the same as the Owner/ Engineer may from time to time direct and shall reinstate and make good such part or parts to the satisfaction of the Owner/Engineer. If any such part or parts have been covered up or put out of view after compliance with the requirements of this item and are found to be executed in accordance with the Contract, the expenses of uncovering, making openings in or through, reinstating and making good the same, shall be borne by the Owner as mutually agreed upon but in any other cases all the such expenses shall be borne by the Contractor or may be deducted by the Owner from any money due or which may become due to the Contractor.



18.3 Improper Work and Material

The Owner/Engineer shall during the progress of the works have the right to order in writing from time to time:

- a) The removal from the Site within such time or times as may be specified in the Contract Documents of any materials which in the opinion of the Owner/Engineer are not in accordance with the Contract Documents.
- b) The substitution of proper and suitable materials, and
- c) The removal and proper re-execution (notwithstanding any previous test thereof or interim payment thereof) of any work which in respect of materials or workmanship is not, in the opinion of the Owner/Engineer, in accordance with the Contract Documents.

In case of default on the part of the Contractor in carrying out orders, the Owner shall be entitled to employ and pay other persons to carry out the same and all expenses consequent thereon or incidental thereto shall be borne by the Contractor and shall be recoverable from him by the Owner or may be deducted by the Owner from any money due or which may become due to the Contractor.

18.4 Temporary Arrangement

The Contractor shall bear all expenses and charges for special or temporary way-leaves required by him in connection with access to the Site.

19.0 ERECTION/CONSTRUCTION TOOLS, TACKLES AND MACHINERY

19.1 Tools, Tackles and Machinery

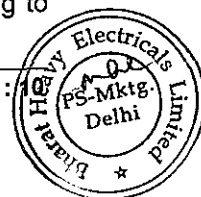
The Contractor shall provide all construction/erection machinery, tools, tackles and scaffolding required for the Works. A detailed list of the above, together with their capacities and present conditions, etc. shall be submitted to the Owner/Engineer at least three (3) months before the commencement of Site work.

19.2 Exclusive use of Machinery

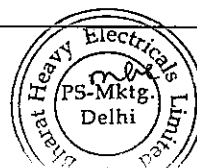
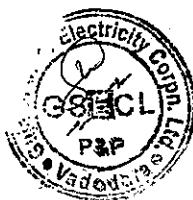
All erection and construction machinery, temporary works and materials provided by the Contractor shall, when brought on to the Site, be deemed to be exclusively intended for the execution of the Work, and the Contractor shall not remove the same or any part thereof for any other use.

20.0 URGENT REPAIR WORK

If, by reason of any accident or failure or other event occurring in connection with the Works, either during the execution of the Works or during the Warranty period, any remedial or repair work is necessary, then the Contractor shall take necessary remedial action. If however the Contractor is unable or unwilling to



do such repairs, the Owner may use his own or other workmen to do the repairs. The cost of repairs so done shall be charged to the Contractor or may be deducted by the Owner from any money due or which may become due to the Contractor.

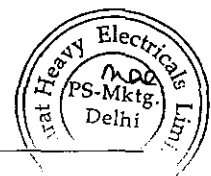


SECTION-3

GENERAL CONDITIONS

DEVELOPMENT CONSULTANTS

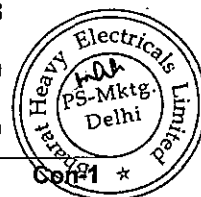
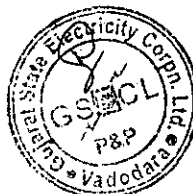
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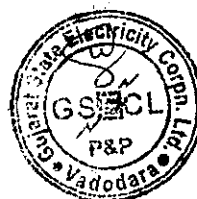
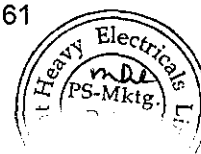
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GENERAL CONDITIONS
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SECTION-3 GENERAL CONDITIONS

1.0 APPLICATION

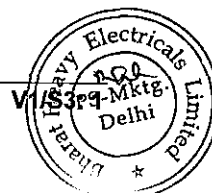
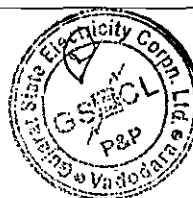
These General Conditions shall govern the Works.

2.0 DEFINITION OF TERMS AND INTERPRETATION

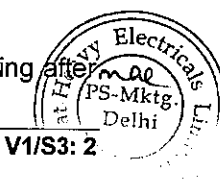
2.1 Definitions:

- In this Contract (as defined below), unless the context requires otherwise, the words and expressions defined below shall have the meaning hereinafter assigned to them.
- **"Advance Payment Bank Guarantee"** shall have the meaning assigned to the term under Clause 8.2 of this GCC.
- **"Annexure"** shall mean all appendices, annexure, tables and schedules annexed to this Contract or incorporated by reference herein and shall include all amendments and revisions thereto made by mutual agreement of the Owner and Contractor in accordance with the provisions contained in this Contract.
- **"Acceptance Test/Performance Guarantee Test"** for equipment /system shall mean such tests as are required to determine and demonstrate guaranteed capacity, efficiency and operating characteristics of the equipment /system Plant as stipulated in the Contract Document.
- **"Applicable Laws"** shall mean Constitution of India, all laws, treaties, ordinances, rules, directives, regulations and amendments thereto made from time to time and in force and effect in India, judgments, decrees, injunctions, writs and orders of any court, arbitrator or authority, rules, regulations, orders and interpretations of any Governmental Instrumentality, court or statutory or other body having jurisdiction over the subject matter of the Contract, as may be in effect at the time of performance of Work hereunder by the Contractor, provided, however, that if at any time the Applicable Laws are less stringent than the standards set forth in the Contract, Contractor shall not be excused from meeting the standards set forth herein.
- **"Approved"** and **"Approval"**, where used in the Contract shall mean respectively, approved by and the approval of the Owner or the Owner's Representative in writing.

When the words 'Approved', 'Approval', 'subject to Approval', 'Satisfactory', 'Equal to', 'Proper', 'Requested', 'As directed', 'Where directed', 'When directed', 'Determined by', 'Accepted', 'Permitted', or words and phrases of like import are used the approval, judgment, direction etc is understood to be a function of the Owner or the Owner's Representative.



- **"Auxiliary Power Consumption"** shall mean the electrical energy (in kW) consumed by all the equipments, systems etc. forming part of the Plant and provided by the Contractor in pursuance of the Contract over a period of one hour i.e. difference of Gross Power measured at Generator Terminals and Net Power measured at 400 KV side of Generator Transformers, when the Plant is operating at rated capacity (guaranteed) measured in accordance with the procedures detailed in the Technical Specifications.
- **"Bidder"** shall mean duly established reputed organizations, manufacturers, etc. having requisite financial and technical capability and experience of participating in the Bid invited by the Owner for the Works. [
- **"Bank Guarantee" or "Performance Bank Guarantee" or "Bonds"** shall mean the primary, irrevocable, and unconditional on demand bank guarantees from Indian nationalized bank, to be furnished by the Contractor as a security for his performance under the Contract and the Advance Payment payable to the Contractor in accordance with Clauses of the General Conditions of Contract.
- **"Cause"** in relation to the revocation or amendment of any Permit shall mean any fact or circumstance, including without limitation any default, neglect or failure to abide by any of the terms and conditions of such Permit, which legally entitles the issuing authority to revoke the Permit or make the relevant amendment in its terms and conditions.
- "Ceiling"** shall mean an upper limit for payment inclusive of applicable taxes & duties, by the Owner to the Contractor for various services rendered in pursuant to Contract as well as deduction towards Liquidated Damages for delay in Commercial Operations or otherwise shortfall in Performance Guarantee
- **"Contractor"** shall have the meaning assigned to the term in the Contract Agreement and shall include its legal successors in title approved by the Owner, who satisfy the qualification criteria set forth in the Tender Document,
- **"Contract" or "EPC Contract"** shall mean the Contract Agreement, Contract and such further documents as may be expressly incorporated in the Contract by reference and all amendments in writing made to any of them in accordance with the provisions contained in this behalf in the Contract and executed by duly authorized representatives of the Parties and shall include such other document that the Parties may have agreed in writing.
- **"Consultant"** shall mean Development Consultants Pvt. Ltd., Consulting Engineers, whose office is situated at GR. HQ.: 24 Park Street, Kolkata – 700 016, or any other agency (engaged for specific purpose) appointed by the Owner for the Project implementation and shall include their duly authorized representatives.
- **"Change in Law"** shall mean the occurrence of any of the following after

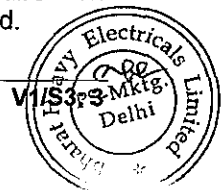


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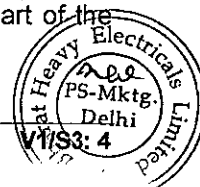
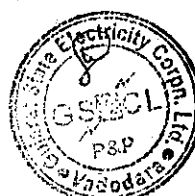
- (a) the enactment of any new Applicable Law.
- (b) any modification or repeal of any existing Applicable Law or any new or modified directive or order there under,
- (c) Any change in the interpretation or enforcement of any Applicable Laws by a competent legislature of Government Agency in India which is contrary to the existing accepted application or interpretation thereof, provision for which has not been made elsewhere in the Agreement.

provided that "Change in Law" shall not include

- (i) any change in the interpretation or application of any Applicable Law except as provided in (c) above; and
 - (ii) any enactment, modification, repeal, interpretation or application of any Applicable Law of India which increases market prices of goods, commodities, labour and services in general.
- **"Change Order"** shall mean a written order from the Owner to the Contractor after the Commencement Date of the Contract requiring a change in any part of the Work that may involve:
 - (a) a change in the scope of Work,
 - (b) additional work, or
 - (c) the omission of a portion of the Work, and
 - (d) if appropriate, an adjustment in one or more of the (i) Contract Price, (ii) Guaranteed Commercial Operation Date, (iii) Milestone Payment Schedule, (iv) any of the Performance Guarantees, or (v) any provision/scope of this Contract including any Appendices or Schedules hereto.
 - **"Codes" or "Indian Standards and Codes"** shall mean the latest applicable Indian and international technical codes and standards, whether required by statute or not.
 - **"Commencement Date" or "Zero Date"** shall mean the date on which the Contractor is to commence performance of Work or its obligations under the Contract as specified in the Notice to Proceed delivered by the Owner to the Contractor under and in accordance with the Contract.
 - **"Commissioning"** shall mean the first successful operation of each equipment / systems provided by the Contractor, and the Plant as a whole at full load (after the Mechanical Completion), without any problem/interruption, in accordance with the Contract, after all initial adjustments, cleaning, re-assembly, and Trial Run, as required on completion of installation of Plant at site, have been completed.



- **"Commercial Operation"** shall mean, operation of the Plant upon Commissioning and successful completion of all the Tests before Commercial Operation.
- **"Commercial Operation Date"** or **"COD"** shall mean the date mentioned in the Provisional Acceptance Certificate which will be issued by the Owner, upon the satisfactory completion of reliability run and Plant entering into Commercial Operation, and the Plant becoming available for continuous operation on 24X7 basis for commercial sale of power by Owner,.
- **"Company Contractor"** shall mean any Person other than the Contractor under contract with the Owner with respect to the Project.
- **"Completed Performance Test"** shall mean with respect to each equipment / systems / Plant, the Performance Test conducted in accordance with the contract during which the equipment / systems / Plant and the operation thereof comply with all Applicable Laws and the Performance Guarantees and which are established as completed Performance Test in accordance with the provisions of the contract in this behalf herein.
- **"Confidential Information"** shall mean information now or hereafter owned by or otherwise within the possession or control of a Party, including patented and unpatented inventions, business and trade secrets, know-how, techniques, data, specifications, as-built drawings, blue prints, flow sheets, designs, engineering information, Construction information, operation criteria, and other intangible information related to the Project.
- **"Consequential Damages"** shall mean indirect, punitive, special or incidental damages, the loss of profits or revenue, loss of use of the Equipment or any associated equipment, cost of capital and/or financing, down time costs, loss of opportunity, loss of goodwill, and claims of customers for such damages, except the damages provided under the Contract.
- **"Consignee"** shall mean the authorised representative or officer of the Owner to whom the Equipment is required to be delivered in the manner indicated in the Contract and whose identity shall have been notified by the Owner in good and sufficient time having regard to the Contractor's schedule for the delivery of the Equipment.
- **"Consumables"** shall mean all lubricants, lubrication and control oils, greases, filters, jointing & packing materials, hardware, demineralising resins and water treatment chemicals etc. required for operation of the Plant.
- **"Contract Agreement"** shall mean the agreement signed by the Parties to which these General Conditions of Contract, Schedule of Liquidated Damages and other documents and agreements forming part of the Contract are scheduled.



- " **Project Network/ Master Network**" shall mean the Network covering details like:

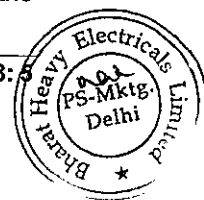
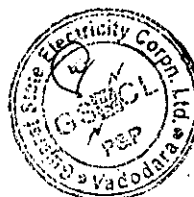
design, engineering & manufacturing and procurement schedule for the Equipment identifying all systems and Equipment and milestone dates for manufacture, assembly, inspection/ shop testing, shipment and delivery.

erection, Commissioning and testing schedule till Take-Over,

design, engineering, Construction, fabrication schedule for the Project identifying all buildings, structures and milestone dates for various Construction activities.

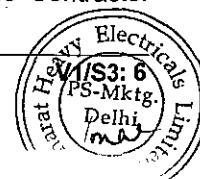
Bar chart covering critical and parallel activities indicating period

- **Contract Period** shall mean the period from the Commencement Date/ Zero Date till Take Over of the Plant. Provided that the expiry of the Contract Period shall not affect the obligations of the Contractor beyond the Contract Period, as specified under the Contract
- **"Contractor's Works" or "Manufacturer's Works"** shall mean the places which are used by the Contractor or any of its sub-vendor/sub-contractor for the manufacture of Equipment for the Plant or performance of Work, designated by Contractor and communicated to the Owner.
- **"Contractor's Equipment"** shall mean all machinery, apparatus, equipment, appliances, materials, items and other things of whatsoever nature required for the execution and completion of the Works, performance of the Contractor's obligations under the contract including Work, establishing of Performance Guarantees, and the remedying of any defects and deficiencies, but does not include Equipment and other things intended to form or forming part of the Plant.
- **"Contractor Permits"** shall mean all those Permits, required by the Contractor from any Government Instrumentality for the performance of any of the obligations of and Work by the Contractor under the Contract, including without limitation, all registrations and licenses required to permit the Contractor to do business in the jurisdiction where it has to perform any part of the work, inclusive of all the Permits, authorizations, consents and approvals required solely for Construction, Commissioning, testing operation of the Plant and transmission of electricity to GETCO.
- **"Contractor's Representative"** shall mean the person named as such in the Contract or other person appointed from time to time by the Contractor in his place in accordance with the Contract, , and such appointment communicated to the Owner,.
- **"Country"** shall mean India, where the works are to be executed and to which Equipment are to be delivered.
- **"CIF Price"** shall mean delivery free of expenses to the Owner on board the



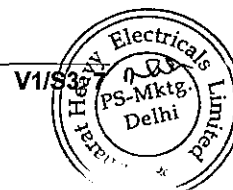
vessel at the port of entry including the insurance and freight charges.

- **"Contract Document"** shall mean and include the General Conditions of Contract, Special Conditions of Contract, Minutes Of Meeting dated [insert] between Owner and the Contractor, the Final Proposal of Contractor dated [insert] as accepted by the Owner, Specifications, Schedules, Annexures, Drawings, Schedule of Prices and Schedule of Quantities submitted by the Successful Bidder, Letter of Intent, Notice to Proceed issued by the Owner, subsequent amendments to the foregoing in accordance with the terms of the Contract.
- **"Contract Price"** shall mean the agreed sum of money stated in the Contract to be paid to the Contractor for the successful completion of the Works and obligations, in accordance with the terms of the Contract.
- **"Day" or "Days"** shall mean a Gregorian calendar day
- **"Defects Liability Certificate"** shall mean the certificate, which the Owner shall issue to the Contractor when the Warranty Period or Extended Defects Correction Period, whichever is later, for the Plant including Equipments has expired, and the Contractor has fulfilled all his obligations under the Contract for such defects.
- **"Directive or Owner's Instructions"** shall mean any requirement, instruction, clarification, direction, order, regulation, code, standard or rule of any Competent Authority, which is legally binding and any modification, extension or replacement issued by the Owner or the Consultant in writing to the Contractor from time to time during the subsistence of the contract.
- **"Documents"** shall mean all design documents, engineering documents, drawings, calculations, computer software (programs), computer diskettes and tapes, audio and video tapes, samples, patterns, models, Construction documents, erection documents, quality plans, inspection reports, field quality plans and test reports, operation and maintenance manuals, and other manuals, and all other data and information to be submitted by the Contractor and shall include without limitation engineering, design and Construction drawings, data sheets, specifications, plans, bills of materials and estimates etc.
- **"Drawings" shall mean**
 - a) Drawing furnished by the Consultant/Owner .
 - b) Supplementary drawings if any furnished by the Consultant/ Owner to clarify and to define in greater detail the intent of the Contract.
 - c) Drawing submitted by the Contractor with his Final Proposal provided such drawings are acceptable to the Consultant/ Owner.
 - d) Drawing furnished by the Consultant/Owner to the Contractor

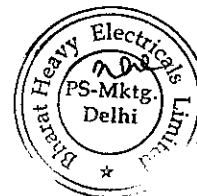
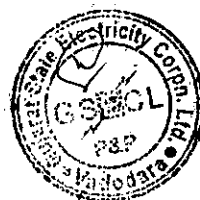


during the progress of Work.

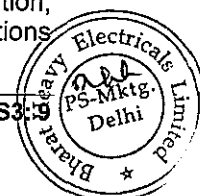
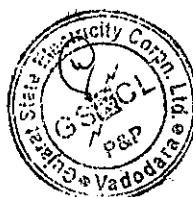
- e) Engineering data and drawings submitted by the Contractor during the progress of Work, provided such engineering data and drawings are acceptable to the Consultant/Owner.
- **"Engineer"** shall mean an officer of the Owner as may be duly appointed and authorised in writing by the Owner for the purpose of the Contract.
 - **"Equipment" or "Equipments" or "Equipment(s)"** shall mean all of plant, systems, equipments, and Materials specified in Schedule to be supplied under the Contract and such other equipment and materials as may be agreed between the Owner and the Contractor, necessary for incorporation in the Plant.
 - **"Extended Defects Correction Period"** shall mean, in relation to any individual item of Work or Equipment comprised in the Works, which has been rectified, repaired, or replaced, twelve (12) months from the date of such rectification, repair or replacement or twenty four (24) months from the date of COD of the Plant whichever is later.
 - **"Ex-Works"** shall have the meaning ascribed thereto under Incoterms.
 - **"Facility" or "Plant"** shall mean the **1x800 MW** supercritical thermal power plant including , all the Equipments, together with all auxiliaries, and related buildings and Civil works of the said power plant to be constructed at Wanakbori, Kheda District, Gujarat, India, as an integrated whole, including without limitation all systems and sub-systems thereof and related facilities, including without limitation any and all appliances, parts, instruments, appurtenances, accessories and other property that may be incorporated or installed in or attached to or otherwise become part of the Plant or as envisaged in the Contract or which otherwise constitutes a part of the Plant and located on Site.
 - **"Facility Site" or "Site"** shall mean land at Wanakbori, Kheda District, Gujarat, India, owned by Owner on which the Facility will be located, as more particularly identified on the site plan and as described in drawings attached to Contract hereto as Annexure [insert].
 - **TAKE OVER CERTIFICATE** shall mean, in relation to the Plant, the certificate issued by the Owner confirming the Owner's Take Over of the Plant as being complete in every respect in accordance with clause No. 20.0 of the General Conditions of Contract, after Provisional Plant Acceptance Certificate is issued and liquidation of the punch lists and pending issues, after completion, synchronization and placed in Commercial operation in accordance with the contract, except for the warranty in respect of Plant/Equipments under the Extended Defects Correction Period, Latent Defects and Warranty for Mandatory Spares.



- **"Final Proposal"** shall mean the document containing the final technical & commercial proposal of Contractor for the Plant as may be modified in accordance with the provisions of the Tender Document, and agreed to in writing by the Owner and shall include but not be limited to technical information, data, documents and drawings forming part thereof, annexed as Annexure [inesrt] to the Contract.
- **"Financial Closure"** shall mean the date on which the **Financing Documents providing for funding by the Lenders have become effective.**
- **"Financing Documents"** shall mean any and all agreement or agreements, notes, bonds, indentures, political risk insurance policies, credit agreements, debt repayment or refinancing instruments, reimbursement agreements, mortgages, security agreements, guarantees, registration statements, disclosure statements, subordination agreements, partnership agreements, lease agreements, participation agreements and other documents relating to the Construction, interim or long-term financing (and any refinancing of the same) of the Project, including any modifications, extensions, renewals or replacements of the same entered into by the Owner for the provision of finance in connection with the Project.
- **"First Synchronisation"** shall mean electrical connection of plant to the Grid by Interconnection of the Facility for the first time after matching of voltage, phase sequence and frequency after satisfactory Commissioning of TG and STG.
- **"Force Majeure"** shall have the meaning set forth in clause 28.0 of these General Conditions of the contract.
- **"Foreign Currency"** shall mean a freely convertible currency such as US \$, Japanese Yen, Pound Sterling, Swiss Francs & Euro specified in the Schedule of Prices and Schedule of Delivery in which the Contract Price is payable, but not Indian Rupees.
- **"F.O.B"** shall mean delivery free of cost to the Owner on board the vessel at the port of shipment.
- **"F.O.R. Destination"** shall mean delivery free of expenses to the Owner on board rail wagons at the railway siding at the Site or its nearest railway station including the insurance coverage.
- **"F.O.R. Works"** shall mean loaded and stowed or trimmed free of expenses to the Owner on board rail wagons at the Contractor's Works siding or it's nearest railway station for transportation.
- **"F.O.R. Site"** shall mean delivery free of expenses to the Owner at his Site.
- **"GUVNL"** shall mean Gujarat Urja Vikas Nigam Limited including its successors in title and assigns of its interest.
- **"General Conditions of Contract"** or **"GCC"** shall mean these Conditions of Contract' as amended in accordance with the provisions contained in this behalf herein.

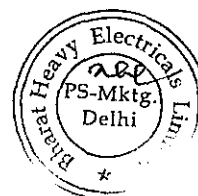


- **"Guaranteed Commercial Operation Date"** shall mean the date by which the Contractor has guaranteed to make the Plant ready for Commercial Operation after successful completion of Reliability Run.
- **"Guaranteed DM Water Consumption"** shall mean the guaranteed demineralised water consumption for the plant operation as stated at CL3.02.01 of VOL IIA/S-10
- **"Good Engineering Practices"** shall mean those practices, methods, acts, techniques and standards as may be followed or employed in the performance of the work and discharge of its obligations by the Contractor and which (i) are generally accepted internationally for use in the electric utility industry, taking into account conditions in India, in connection with power plants of the same or similar size and type as the Plant, (ii) are commonly used in prudent electric utility engineering, construction, project management and operations, and (iii) would be expected to result in performance of the services and completion of Works in a manner consistent with Applicable Laws, Applicable permits, reliability, safety, environmental protection, economy and expediency.
- **"Government Instrumentality" or "Competent Authority"** shall mean the Government of India, the Government of Gujarat, or any political subdivision, ministry, department, agency, corporation, commission or any regional, local or municipal authority or governmental body thereof or any other governmental or statutory body under the direct or indirect control of the Government of India or Government of Gujarat, or of any political subdivision, ministry, department, agency, corporation, commission, or any regional, local or municipal authority or governmental body thereof, and shall include without limitation any other governmental or statutory body in India having jurisdiction over the Plant or over the performance of any part of Work or the Works or any obligation of the Contractor or the Owner under the contract.
- **"Grid"** shall mean the system of electrical transmission and distribution of GETCO interconnecting different generating stations, transmission lines, sub-stations, circuits, transformers, switchgear and other equipment upto and on the GETCO side of the Interconnection Point.
- **"GETCO"** shall mean the Gujarat Energy Transmission Corporation Limited.
- **"Goods"** shall mean Equipment to be supplied under the Contract
- **"Reliability Run"** shall mean the first continuous operation of the Plant with sub-systems under varying loads to demonstrate satisfactory operation for a specified period (14 days) after completion of successful Initial Operations and conditions as specified elsewhere in the Contract.
- **"Hazardous Materials"** shall mean (i) hazardous materials, hazardous wastes, hazardous substances, toxic substances or contaminants as those terms are defined under any environmental law or regulation, including, but not limited to, Applicable Laws, and in the regulations



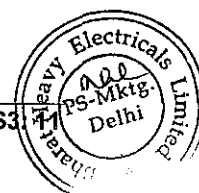
adopted or promulgated pursuant thereto; (ii) petroleum and petroleum products including crude oil and any fractions thereof; (iii) any other hazardous, radioactive, toxic or noxious substance, material, pollutant, or solid, liquid or gaseous waste; and (iv) any substance that, whether by its nature or its use, is subject to regulation under any environmental law or with respect to which any applicable environmental law or any Governmental Instrumentality requires environmental investigation, monitoring or remediation.

- **"Incoterms"** shall mean **"International Rules for the Interpretation of Trade Terms,"** as adopted by the International Chamber of Commerce (the "ICC") and as in force on the date of invitation of the bids. All matters relating to the Construction and interpretation of Incoterms shall be resolved by reference to the Guide to Incoterms.
- **"Taxes"** shall mean all taxes, duties, and cess imposed by the Government of India or any of its subdivisions (including value added tax), excise, storage and consumption taxes, service tax, import duties and customs duty and fees, license fees, sales and/or purchase taxes, octroi, entry tax, and labour cess applicable to any portion of the Works or Supplies, or any other tax, duty or fee of similar nature irrespective of the nomenclature used for the same
- **"Personal Taxes"** shall mean all taxes on income, profit, other real and personal property and franchise taxes, as well as personal income taxes of the Parties or any authorised persons acting on behalf of the Parties; and all applicable national, state and local payroll, social security, workers' compensation, employment taxes and contributions imposed by Applicable Law with respect to or measured by compensation (wage, salaries or other) paid to employees of the Parties, including taxes, health and welfare funds, pensions and annuities, disability insurance and all other similar social payments.
- **"Initial Operation"** with respect the Plant shall mean all operations undertaken as part of "Commissioning" after completion of "Preliminary Operation" first synchronization and upto commencement of "Trial Run". It shall be the first integral operation of the Plant including all Equipment / Systems, and shall include first light up / initial equipment rolling, equipment stretch-out, dry-out and operational chemical cleaning, no-load / partial load / full load runs for mechanical / electrical tryout and gathering of operational data; calibration, setting and Commissioning of control systems; and shutdown inspection and adjustment after running trials of the Plant including the Equipment.
- **"Inspector"** shall mean the authorized representatives appointed by the Owner or the Consultant for purpose of the inspection of Equipments for the purposes of the Contract.
- **"Interim Payment Certificate"** shall mean any payment certificate other

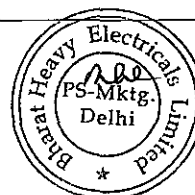


than Final Payment Certificate, issued by the Owner or Owner's Representative pursuant to clause 8.12.1 other than the final payment certificate.

- **"Interconnection Facility"** shall mean all the facilities to be provided by the GETCO on the Site on GETCO's side of the Interconnection Point the location of which is specified in the Technical Specifications.
- **"Interconnection Point"** shall mean the 400kV Switchyard outgoing gantry from where the power is evacuated to the Grid by GETCO.
- **"Intellectual Property Rights" or "IP Rights"** shall mean copyright, all rights conferred under statute or common law in relation to inventions (including patents), registered trademarks, registered designs, circuit layouts, confidential information and all other rights resulting from intellectual activity in the industrial, scientific, literary or artistic fields
- **"Latent Defect"** shall mean the defects in design, materials and could not have been found prior to expiry of the Warranty Period mean a defect, which was in existence during the applicable Warranty period but was not reasonably discoverable during such Warranty period.
- **"Lenders"** shall mean those banks, firms or institutions who make available, from time to time, financing for the Project and whose identities have been notified to the Contractor.
- **"Letter of Intent" or "LoI"** shall mean the formal communication in writing by the Owner to the Contractor of the acceptance of the Contractor's Bid.
- **"Lien(s)"** shall mean any lien, claim, charge, encumbrance, cause of action, security interest, mortgage or other possessory or non-possessory interest in, on or against real, tangible or intangible property as administered under Applicable Law arising out of, due to, or otherwise as a result of the Contractor's acts or omissions, including any lien recorded or held by any Sub-Contractor or any other person entitled to a lien under Applicable Law.
- **"Limits of Rejection"** shall mean the limits prescribed to each of the Performance Guarantees, which if not adhered to, the Project shall be liable for rejection
- **"Liquidated Damages"** shall have the meaning as specified in 11.0 of the GCC.
- **"Local Currency"** shall mean the Indian Rupees.
- **"Manufacturer"** shall mean any entity or firm who is the producer and furnisher to the Contractor of any material or designer and fabricator of any equipment / systems which is to be incorporated in or forms part of the plant / works.
- **"Mandatory Spares"** shall mean the mandatory spares, and maintenance tools and tackles for the Plant, as specified in the Specifications, to be supplied by the Contractor under the Contract.

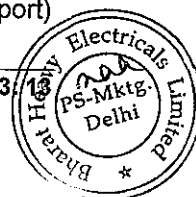
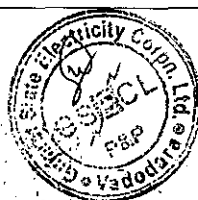


- **"Materials"** shall mean things of all kinds to be provided and incorporated in the Plant by the Contractor, including the items which are to be supplied by the Contractor under the Contract.
- **"Mechanical Completion"** shall mean with respect to the Plant, the completion of all works by the Contractor including completion of Construction, erection, installation, calibration and construction; testing services with respect to all mechanical, electrical, civil & structural, instrumentation and control systems (including Equipment) of the Plant, and the Plant has achieved a state of readiness for "Preliminary Operation". The existence of Punch List and pending issues items which do not prevent or adversely affect the Plant performance and safety, from being in a state of readiness for "Preliminary Operation" shall not be construed as preventing the Plant, from achieving Mechanical Completion.
- **"Milestone Payment Schedule"** shall mean the document, provided in Annexure [insert] hereof which sets forth (i) payments to be made by the Owner to the Contractor on schedule specified therein, and (ii) links each such payment with Project Milestones commencing on the Commencement Date. The Milestone Payment Schedule divides the contract price payment among certain progress milestones and may otherwise be adjusted from time to time in accordance with the contract.
- **"Month"** shall mean a month according to Gregorian calendar.
- **"Monthly Progress Report"** or **"Progress Report"** shall mean a progress report meeting the requirements set forth in clause 29 of the specification hereto.
- **"Notice to proceed"** or **"NTP"** shall mean the Owner's letter or notification intimating the Contractor to commence the Works.
- **"Notice in Writing"** or **"Written Notice"** shall mean a notice in writing, typed or printed or hand written characters, sent (unless delivered personally or otherwise proved to have been received) by registered post or by any agreed system of electronic transmission to the last known private or business address or registered office of the addressee and shall be deemed to have been received when in the ordinary course of post it would have been delivered.
- **"Operation Manual"** shall have the meaning set forth in Specification hereof.
- **"Owner"** or **"Purchaser"** shall mean Gujarat State Electricity Corporation Limited (GSECL) and shall, unless repugnant to the context thereof, include its successors, assigns as well as authorized officers & representatives.
- **"Owner's Representative"** shall mean the person appointed by the Owner from time to time and notified as such to the Contractor to act as Owner's Representative for the purposes of the Contract.
- **"Owner's Instructions"** or **"Owner's Representative's Instructions"**



shall mean any drawings, specifications, instructions, details, directions and explanations, in writing issued by the Owner or by the Owner's Representative /Consultant from time to time during the subsistence of the Contract

- **"Owner or Purchaser"** shall mean Gujarat State Electricity Corporation Limited and shall include its successor(s) and assigns.
- **"Prime Bidder"** shall mean a reputed organization who submits a Bid and assumes single point responsibility acting by himself or on behalf of his associates. The Prime Bidder will be the party who will be contractually bound to the Owner.
- **"Owner Permits"** shall mean those Permits, No Objection Certificate (NOC), authorizations, consents and approvals required by the Owner to own, possess, operate and maintain the Plant and to generate electrical energy there from,
- **"Party"** shall mean either of the Owner or Contractor individually and **"Parties"** shall mean Owner and Contractor collectively.
- **"Permanent Works"** shall mean the permanent works, equipment and materials including all civil, electrical, control & instrumentation and mechanical works to be designed, engineered, manufactured, supplied, installed, erected, executed, Commissioned in accordance with the Contract and which form part of the Plant.
- **"Performance Guarantees"** shall mean the guaranteed capacity, efficiency and operating characteristics of the Plant as stipulated in Schedule of the Contract and Specifications.
- **"Performance Guarantee Tests"** shall mean, the tests specified in the Specifications and Schedule of the Contract to be conducted by the Contractor after entry into Commercial Operation of the Plant at the Site by the Contractor, other than the Tests before Commercial Operation, which shall be performed to demonstrate the achievement of Performance Guarantees, and shall be successfully conducted within three (3) Months of entry into Commercial Operation of the Plant.
- **"Performance Test"** with respect to the equipment/systems of the Plant shall mean the test to establish their design / rated performance conducted at site by the Contractor in accordance with the provisions of the contract.
- **"Permit"** shall mean any valid permit, authorization, license, registration, approval, consent, waiver, exemption, variance, franchise or any similar order of or from of any Government Instrumentality, court or other body having jurisdiction over the matter in question.
- **"Person"** shall mean any individual, corporation, partnership, association, joint stock company, trust, unincorporated organisation, joint venture, government or political subdivision or agency thereof.
- **"Port of Entry"** shall mean the final destination in India (sea or airport)



where customs duty, port and other handling charges are paid on imported materials.

- **"Power Purchase Agreement"** shall mean the Agreement between the Owner and the GUVNL for sale of electrical energy generated by the Facility to GUVNL.
- **"Preliminary Operation"** shall include all activities undertaken as part of Commissioning after Mechanical Completion up to commencement of Initial Operation and shall include mechanical and electrical checkouts, adjustments, calibration of instruments and protection devices, Commissioning of sub / supporting systems and static chemical cleaning of the Plant.
- **"Project"** or **"Plant"** shall mean the Facility and the work as an integrated whole, all as described in greater detail in the specification hereto.
- **"Project Documents"** shall mean the Power Purchase Agreement, the Financing Documents, the Contract, any Operation and Maintenance agreement in respect of the Plant, all fuel purchase agreements, all fuel transportation agreements and all other contracts relating to the Plant entered into by the Owner and shall include all Drawings and documents
- **"Protocol"** shall mean the statement of readings of any or all of Tests Before Commercial Operation and/or Performance Guarantee Test or any other tests performed by the Contractor under the Contract (which test has been witnessed by the Owner) and jointly signed by Owner and/or his representative or Inspector and Contractor and/or his representative.
- **"Provisional Acceptance Certificate"** shall mean the certificate issued by the Owner to the Contractor evidencing achievement of the COD by the Contractor.
- **"Prudent Utility Practices"** shall mean those practices, methods, equipment specifications and standards of safety and performance, as the same may change from time to time, as are generally accepted for use in electricity generating utilities taking into account conditions in India and commonly used in prudent electricity generation utility engineering and operations including design, engineering Construction, erection, Commissioning, operation and maintenance of power generating stations and equipment comprised therein lawfully, safely, efficiently and economically for facilities of the type and size similar to the Plant and that generally conforms to the Equipment manufacturer's operation and maintenance guidelines.
- **"Punch List"** shall mean the list in respect of the equipment / systems supplied / erected / commissioned, first prepared by Owner at the time of issuance of Provisional Acceptance Certificate of the equipment / systems, and thereafter periodically revised by Owner as necessary, which list shall set forth certain items of Work which remain to be performed by the Contractor in order to ensure that the Plant fully complies with all of the standards and requirements set forth in the Contract.

