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

VOLUME: II B & III

TECHNICAL SPECIFICATIONS
FOR
CHLORINATION PLANT

SPECIFICATION NO.: PE-TS-408-174-A001

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

VOLUME – IIB

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VOLUME II B

SECTION-A

INTENT OF SPECIFICATION

1.0 INTENT OF SPECIFICATION

1.1 The specification is intended to cover design, engineering, manufacture, fabrication, assembly, 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 **COOLING WATER (CW) & RW WATER (RW) CHLORINATION PLANT & ABSORPTION SYSTEM** as per the details in different sections / volumes of this specification for **1X800 MW WANAKBORI STPP.**

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

SECTION: B

PROJECT INFORMATION WITH WIND AND SEISMIC DESIGN CRITERIA

VOLUME : IIA

SECTION-II

PROJECT SYNOPSIS AND GENERAL INFORMATION

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

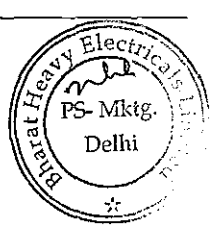
The proposed extension unit will be developed in the existing Wanakbori Thermal Power Station and will be located north east side of the existing plot in the Kheda District of Gujarat. The land of the proposed plant will be filled in upto a desired level. Existing Ash Pond/ Dyke area will be utilized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



5.00.00 SOURCE OF WATER

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

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

6.00.00 ASH DISPOSAL AREA

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

7.00.00 SALIENT DESIGN DATA

7.01.00 Meteorological data of site is given below:-

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

[Metrological data of Vadodara is attached for reference].

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

Bharat Heavy Electricals Limited PS-Mktg. Delhi

VOLUME : IIA

SECTION-IX

SALIENT DESIGN DATA

[TABLE-I TO TABLE-VII]

CONTENT

TABLES	DESCRIPTION
TABLE-I	~~CLARIFIED WATER ANALYSIS~~
TABLE-II	~~RAW WATER ANALYSIS~~
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

TABLE-III

ESTIMATION OF CONSUMPTIVE WATER REQUIREMENT

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

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TABLE-IV

ANALYSIS OF COAL

PROXYMATE ANALYSIS

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

ULTIMATE ANALYSIS

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

TABLE-V

ASH ANALYSIS
(As Received)

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

TABLE-VI

FUEL OIL ANALYSIS

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

TABLE-VI

FUEL OIL ANALYSIS – FURNACE OIL FO

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

TABLE-VII
CLIMATOLOGICAL TABLE OF BARODA

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

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

* Occurred More Than Once

STATION : Baroda 42747 .. contd

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

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

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

STATION : Baroda (A) 42748 .. contd

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

Seismic Location

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

Wind Pressure

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

SECTION: C

TECHNICAL SPECIFICATIONS

SECTION: C 1

SPECIFIC TECHNICAL REQUIREMENT FOR MECHANICAL

1.0 GENERAL

The **Chlorination Plant** 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 P&ID) and same shall be included in bidder scope. Please also refer Electrical (Section-C1) & C&I (Section-C2) for respective scopes.

1) Entire CW & RW Chlorination and Absorption system as per P&ID (PE-DG-408-174-A001) and Data Sheet-A.
2) Complete Supply of 46 numbers filled chlorine ton container (each of 900 Kg capacity, approx) for CW Chlorination plant with accessories like isolation valves, valve hood etc.
3) Complete Supply of 8 numbers filled chlorine ton container (each of 900 Kg capacity, approx) for RW Chlorination Plant with accessories like isolation valves, valve hood etc.
4) Chlorine manifold consisting of straight lengths of pipe, fittings, isolation valves, automatic shut-off valves, liquid expansion chamber fitted with rupture discs, pressure indicator, Temperature indicator, pressure switch, alarms etc. will be provided. Pressure reducing & shut-off valves shall be provided in the chlorine gas line.
5) Four numbers CW Chlorination each of 150 Kg/Hr.
6) Two numbers RW Chlorination each of 10 Kg/Hr.
7) Chlorine evaporator (one for each CW and RW chlorinator).
8) Chlorine gas strainers (two for each CW and RW chlorinator).
9) All piping as required and upto the dosing point as Shown in P&ID (PE-DG-408-174-A001).
10) Ejectors as per Data Sheet-A.
11) Booster Pumps (4 numbers for CW Chlorination and 2 numbers for RW chlorination) with accessories.
12) Electrical motor with accessories as per system requirement.
13) Chlorine water diffuser and Mixing system as mentioned in Data Sheet-A and as shown in P&ID.
14) Safety and supervisory instruments as specified in Data Sheet-A.
15) Instrumentation as per P&ID (PE-DG-408-174-A001) (minimum) and system requirement.
16) Chlorine absorption system for RW Chlorination & CW chlorination as per Data Sheet-A and P&ID (PE-DG-410-174-A001).
17) Online Residual chlorine analyzer -1 no for CW Chlorination.
18) Caustic solution preparation cum recirculation tank (one number for each CW and RW).
19) Two numbers Blowers (two for each CW and RW) with accessories as specified in Data Sheet-A.
20) Chlorine gas duct as per Data Sheet-A.
21) All tanks complete with inlet and outlet connections, all fittings and appurtenances etc. as specified and as required.
22) All necessary valves and fittings for the installations with the actuators necessary for their remote operation.
23) PLC based control panel for CW Chlorination Plant and absorption system.
24) PLC based control panel for RW Chlorination Plant and absorption system.
25) PLC with OWS, OEWS, Printer, monitor, furniture for PLC room, UPS, battery etc as required and addressed in this specification elsewhere for CW Chlorination plant.
26) PLC with OWS, OEWS, Printer, monitor, furniture for PLC room, UPS, battery etc as required and addressed in this specification elsewhere for RW Chlorination plant.
27) Exhaust fans and ventilation system as required.
28) Electrical scope shall be as per “Electrical scope between BHEL and Vendor”.
29) All necessary drains, vents and sampling points, with valves, as specified and as required.
30) Hangers and supports as per the requirement.
31) Wrapping/coating for underground piping.
32) Start-up and commissioning spares as required.
33) All special tools necessary for proper maintenance or adjustment of the equipment packed in permanent box.
34) All necessary flanges and counter flanges to interconnect the pipes.

35) Finish paints for touch up painting of equipment's after erection at site in sealed container.
36) Initial charge of all lubricant & grease and first fill of chlorine and all chemical including initial fill of caustic.
37) Lifting and handling arrangement- Electrical hoist 3 ton capacity 1 No each for CW chlorination plant with trailing cable.
38) Lifting and handling arrangement- Electrical hoist 3 ton capacity 1 No each for RW chlorination plant with trailing cable.
39) Weighing machine (@ 3 Ton capacity digital type)-1 No each for CW Chlorination plant.
40) Weighing machine (@ 3 Ton capacity digital type)-1 No each for RW Chlorination plant.
41) Monitoring gadgets, instruments and equipment's required for maintenance (till PG test and plant handover).
42) Air conditioning requirement in CW Chlorination plant PLC room.
43) Mandatory spares and commissioning spares for CW chlorination plant.
44) Mandatory spares and commissioning spares for RW chlorination plant.

3.0 SCOPE OF SERVICE

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

1) Erection and commissioning, unloading, storage and handling at site.
2) Arrangement of all instruments and lab facilities to carry out trial run/commissioning and PG test.
3) Complete grouting for equipment, fixing and any concreting inside the vessels and lining.
4) All personnel required during commissioning and PG Test.
5) Performance testing.
6) 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.
7) All statutory clearance as per CCE Nagpur as applicable.

4.0 CIVIL SCOPE

- Nil. However, complete civil assignment and all steel inserts, plates, bolts, nuts, sleeves and all other embedding components etc as required to grout in bidder's scope and to hold/support the equipments being supplied under this specification shall be done by bidders.

5.0 TERMINAL POINT

a. Inlet motive water line: For CW refer Key plan (enclosed), For RW consider a) 100 meter piping distance from PT plant inlet line and b) 50 meter piping distance from Clarified water overhead tank.
b. Service water and potable water for CW and RW Chlorination plant: At 15 meter from Chlorination plant building at gravity flow.
c. Service Air: At 15 meter from Chlorination plant building.
d. Dosing point- For CW Upto the dosing point refer Key Plan (consider 200 meter piping distance minimum), for RW consider 100 meter piping distance.
e. All drains: To be terminated at Common drain.

Note: Bidder to note that the pipe length indicated in the specification may vary by + 10 % for which no extra claim shall be applicable.

6.0 EXCLUSIONS

a) Service air, upto the terminal point.
b) Air conditioning for RW chlorination plant PLC room, Firefighting facilities. However, bidder to furnish the requirement of same after award of contract.
c) Drinking water and service water.
d) All Civil works at site including Acid/Alkali resistant tiling, excavation/backfilling for underground piping.
e) M.C.C./ Switch fuse feeder panels for the power plant and control cabling up to & beyond the battery limit (Refer electrical section for scope).
f) Monorail for hoist/crane movement is excluded from bidder scope.

7.0 QP AND SUBVENDOR APPROVAL

a) QAP shall be submitted by vendor for BHEL/Customer approval during detailed engineering. Any additional comments as given by BHEL/Customer shall be adhered by the bidder without any implication to BHEL.
b) Approved subvendor list is enclosed elsewhere of this specification. However, any additional sub-vendor shall be subject to BHEL and Customer approval.

8.0 DESIGN/CONSTRUCTION

In addition to the requirements of Section-C & D the following shall also be complied under scope of this specification:
The P&ID is enclosed herein in this section for bidders compliance.

The material of construction specified in Data Sheet-A are minimum requirements and material of construction for other components not specified shall be similarly selected by the bidder for intended duty which shall be subjects to customer approval during detailed engineering.

9.0 DRAWING/DOCUEMNTS REQUIREMENT (FOR MECHANICAL/ELECTRICAL/C&I/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.

a) Detailed piping and instrument or engineering P&ID 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.
b) Detailed configuration drawings, BOMs, Data Sheets, General arrangements and cross-sectional/assembly drags, along with the manufacturer's catalogue for all the items/equipment including control & instrumentation supplied by the bidder.
c) Detailed installation drawings for all instruments and instrumentation schedule.
d) 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..
e) 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.
f) Details civil scope drawing for all civil works.
g) Detailed piping layout drawings, pipe support drawings, complete bill of materials of the piping, valve schedule etc.
h) Submission of O&M manual.
i) P.G Test procedure shall be submitted by bidder during detail engineering and shall be subject to approval by BHEL/Customer.
j) Against customer / BHEL comments bidder has to give replies point wise during detailed engineering after award of contract.
k) Spec. for acid/alkali resistant lining and areas requiring such lining.
l) Cable schedule in BHEL format (shall be handed over after award of contract)

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 woks for trouble free and efficient operation of the plant 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 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: The above Note-1 & 2 shall be applicable for Electrical and C&I also.

1. FUNCTIONAL GUARANTEE (CW & RW CHLORINATION SYSTEM)

1.1 CW CHLORINATION SYSTEM

a) C.W. Chlorination System

i. Each evaporator shall have a normal capacity not less than 150 Kg/hr.

ii. Each chlorinator shall be vacuum solution feed type with a normal capacity of 150 Kg/hr.

b) Emergency Leaked Chlorine Absorption System

i. The outlet air from the absorber must not have free residual chlorine more than 0.1 ppm.

ii. The caustic solution flow rate through the absorber system shall be such that one completely leaked chlorine ton-container content can be absorbed within one hour (maximum) time.

iii. The capacity of Blowers shall be sufficient to suit the above requirement.

c) Various instruments, equipment, chemicals etc. shall conform to the accuracy, ranges and specifications as indicated in specifications of this package.

1.2 RW CHLORINATION SYSTEM

a) Each pump shall be guaranteed for capacity, total dynamic head and power consumption.

b) Each chlorinator shall have a capacity not less than 10 kg/hr.

c) Treated water quality shall be guaranteed for residual chlorine = 0.1 ppm as Cl_2 .

TABLE-1

RAW WATER ANALYSIS [TO BE TREATED IN PT PLANT]		
CONSTITUENTS	**As**	**CONTENT**
Calcium	CaCO3	85.0 ppm
Magnesium	CaCO3	94.0 ppm
Sodium & Potassium	CaCO3	75.0 ppm
Iron in Soln.	Fe	0.05 ppm
Hydrogen (FMA)	CaCO3	Nil.
TOTAL CATIONS (except iron)	CaCO3	254.0 ppm
Bicarbonate	CaCO3	160.0 ppm
Carbonate	CaCO3	Nil.
Hydroxide	CaCO3	Nil.
Sulphate	CaCO3	20.0 ppm
Chloride	CaCO3	52.0 ppm
Nitrate	CaCO3	22.0 ppm
Phosphate	CaCO3	Nil.
Fluoride	CaCO3	0.0 ppm
TOTAL ANIONS	CaCO3	254.0 ppm
Reactive Silica	SiO2	22.0 ppm
Colloidal Silica	SiO2	0.0 ppm
Conductivity at 25 deg C		440 Microsiemens/cm (max)
pH value at 250 C	-	7.5 – 8.0
Suspended Solids	-	800 ppm

TABLE-2

CLARIFIED WATER ANALYSIS [CW MAKE UP WATER]		
CONSTITUENTS	**As**	**CONTENT**
Calcium	CaCO3	85.0 ppm
Magnesium	CaCO3	94.0 ppm
Sodium & Potassium	CaCO3	75.0 ppm
Iron in Soln.	Fe	0.05 ppm
Hydrogen (FMA)	CaCO3	Nil.
TOTAL CATIONS (except iron)	CaCO3	254.0 ppm
Bicarbonate	CaCO3	160.0 ppm
Carbonate	CaCO3	Nil.
Hydroxide	CaCO3	Nil.
Sulphate	CaCO3	20.0 ppm
Chloride	CaCO3	52.0 ppm
Nitrate	CaCO3	22.0 ppm
Phosphate	CaCO3	Nil.
Fluoride	CaCO3	0.0 ppm
TOTAL ANIONS	CaCO3	254.0 ppm
Reactive Silica	SiO2	22.0 ppm
Colloidal Silica	SiO2	0.0 ppm
Conductivity at 25 deg C		440 Microsiemens/cm (max)
pH value at 250 C	-	7.5 – 8.0
Turbidity		15 NTU (max)
Suspended Solids	-	15 ppm

NOTE: The above figures have been arrived with due consideration of injection of 70 ppm Alum, 35 ppm Lime, Poly Electrolyte 1 ppm.

COC OF COOLING TOWER=5

DATA SHEET-A FOR CW CHLORINATION

SL NO.	PARTICULARS	DESCRIPTIONS
1.0	**CAPICITY OF PLANT**	4 Nos @ 150 Kg. /Hr.
2.0	**DOSING**	
2.1	Continuous	1.0 ppm
2.2	Shock	5.0 ppm
3.0	**TON CONTAINER**	
3.1	Type	Ton container
3.2	Nos.	46 . (16 nos connected + 30 nos. spare in storage)
3.3	Capacity	Not less than 900 Kg.
3.4	Size	
3.4.1	Overall length	2085 mm (approx)
3.4.2	Diameter	760 mm (approx)
3.4.3	Test pressure	30 kg/cm2 (g)
3.4.4	Design code	ASME Sec VIII/BS-1500 Pt-1
3.5	Material of construction	ASTM-A-285 Gr.C / ASTM A 515 Gr. 70
3.6	Design pressure / temperature	19.9 Kg./Cm2 (g) / 65 deg C
3.7	Corrosion allowance	1.5 mm (minimum).
3.8	Radiography	100 %
3.9	Heat treatment	Fully stress relieved
3.10	Mounting	Each Chlorine container mounted on two nos. metallic brackets, each provided with two roller supports. These brackets will be mounted on civil foundation and all necessary anchor bolts, inserts, nuts etc. shall be furnished by the chlorination plant supplier.
3.11	Applicable code	Design, fabrication and testing to conform to the regulations of Chief Controller of Explosive. Govt. of India / Chlorination Institute, U.S.A.
3.12	CONTAINER VALVES	One set for each container as per IS-3224 & BS-341 or approved equivalent.
3.12.1	EDUCTOR TUBES	
3.12..1.1	NUMBERS	Two (2) nos. eductor pipes shall be provided for each chlorine toner, terminating into a isolation valve.
3.12.1.2	PURPOSE	One eductor tube will be used for chlorine gas withdrawal while the other shall deliver liquid chlorine.
3.12.1.3	CHANGEOVER MODULE	One (1) chlorine automatic changeover facility with manifolds, valves, instruments & fittings.
3.13	**EXPANSION CHAMBER:**	
3.13.1	Nos.	Min. one or as required in system for each stream with all accessories including wall /flooring bracket with nuts & bolts, necessary inter connecting piping, tube, union, isolating valves etc.
3.13.2	Material	Carbon Steel

3.13.3	Design code	ASME SEC VIII Div 1
3.13.4	Design pressure	40 Kg./cm2 (g)
3.13.5	Thickness	Sch. 80
3.13.6	Radiography	100 % on all butt weld joints.
3.13.7	Hydro test pressure	60 Kg/cm^2 (g)
3.14	**Rupture disc assembly**	
3.14.1	Nos.	One for each assembly.
3.14.2	Type	Bellow/Diaphragm type with local facility for adjustment of set point.
3.14.3	Material	Monel as per ASTM B 164/ASTM A 494 M-35-1 or M-35-2 Silver or as recommended by Chlorine Institute.
3.14.4	Set pressure	28 kg/cm2
3.15	Colour	Each container shall be provided with approved colour band for identification of its content.
4.0	**CHLORINE EVAPORATOR**	
4.1	Nos and Capacity	One for each chlorinator (Total = 4 nos) @ 150 Kg./Hr.
4.2	Type	Electrically heated constant temperature immersion water bath type.
4.3	Location	Indoor
4.4	Accuracy	± 2%
4.5	Materials of construction	
4.5.1	Vaporiser body	Seamless steel tubes as per ASTM A-106Gr.B.
4.5.2	Liquid Chlorine inlet pipe	SA 106 Gr. B Seamless
4.5.3	Bottom flange (inlet chamber)	SA 105
4.5.4	Counter Flange	IS 2062 Gr. B
4.5.5	Flange: Outlet Chamber	IS 2062 Gr. B
4.5.6	Outlet Chamber Pipe	IS: 3589 2001 ERW pipe
4.5.7	Gas outlet pipe	SA 106 Gr. B Seamless
4.5.8	Top Flange (Inner Chamber)	SA 105
4.5.9	Gasket	Asbestos free gasket as per ISO 14001
4.5.10	Inner chamber pipe	SA 106 Gr. B
4.5.11	Super heat baffle pipe	SA 106 Gr. B
4.5.12	Base plate	IS 2062 Gr.B
4.5.13	Inlet and outlet pipe flange	SA 105
4.5.14	Overflow and drain piping	MS IS: 1239 Heavy (Galv)
4.5.3	Corrosion allowance	Min. 3mm.
4.5.4	Welding radiograph	100 %

4.5.5	Heat Treatment	Fully stress-relieved.
4.5.6	Code of fabrication	ASME Sec. VIII Div.I or IS 2825.
4.6	Set Pressure	28 Kg/cm2 (g)
4.7	Hydraulic test pressure	42 Kg./cm2 (g) for leak tightness.
4.7.1	Heat Treatment	Fully stress-relieved.
4.8	Special features	Evaporator shall provide some degree of super heat to present some mist in the downstream side. Each evaporator shall be sized with amply safety factor to allow for partial filling of the chlorine chamber with junk.
4.8	**Accessories**	
4.8.1	Rupture Disc	
4.8.1.1	Number	One (1) for each Evaporator.
4.8.1.2	Type	Bellow/Diaphragm type with local facility for adjustment of set point.
4.8.1.3	Material of construction	Body – Silver coated Carbon Steel.
4.8.2	Expansion Chamber	
4.8.2.1	Number	One (1) for each Evaporator complete with pipe works, unions, isolation valve, nuts and bolts, support brackets and all other accessories.
4.8.2.2	Thickness	Sch. 80
4.8.2.3	Material of construction	Carbon Steel
4.8.2.4	Design Code	ASME SEC VIII Div 1/ IS 2825
4.8.2.5	Radiography	100% on all butt weld joints.
4.8.2.6	Hydro Test Pressure	60 kg/cm2
4.8.2.7	Design Pressure	40 Kg/cm2 (g).
4.8.3	Heating Element	Immersion type, 3-Phase, 415 V, 50 Hz as per IS 4158.
4.8.3.1	Allowable pressure	28 kg/cm^2
4.8.3.2	Material of construction	SS 304 Coil
4.8.4	Pressure Relief Valve	
4.8.4.1	Number	One (1) for each stream.
4.8.4.2	Type	Screwed end full port.
4.8.4.3	Vent Line	The chlorine gas vented from Pressure Relief Valve, shall be led to a Caustic Soda Soak Pit through PVC pipe.
4.8.4.4	Material of construction	Body - Carbon Steel as per ASTM A 105. Diaphragm - PTFE. Trim - Monel.
4.8.4.5	Body Test Pressure	60 kg/cm2
4.8.5	Electrically interlocked shut-off valve at the gas discharge line from Evaporator	Shall be provided.
4.8.6	Water chamber	
4.8.6.1	Insulation Material	Glass Wool Aluminium Sheet
4.8.6.2	Temp of water bath	80 deg. C

4.8.6.3	Joint efficiency	0.7
4.8.6.4	Corrosion allowance	1.5 mm
4.8.7	Cathodic protection system	Sacrificial type Magnesium anode rod 1 set/ Unit to be provided with Ammeter in Control Panel.
4.8.8	One (1) no. Control Cubicle complete with necessary contactors, fuses, push buttons, indication lamps, ammeters and other instruments for each Evaporator.	
5.0	**CHLORINE GAS STRAINERS**	
5.1	Number	Two (2) for each Chlorinator (Total= 8 nos) .
5.2	Capacity	100 % for each Chlorinator.
5.3	Material of construction	Carbon steel SA 105
5.4	Filter Media	Spun Fibre Glass Wool
6.0	**PRESSURE REGULATING VALVE**	
6.1	Number	One (1) for each stream.
6.1.1	Type	Spring loaded silver diaphragm..
6.2	Material of construction	
6.2.1	Body	Carbon Steel as per ASTM A 105.
6.2.2	Diaphragm	PTFE.
6.2.3	Trim	Monel.
6.3	Size	Suitable
6.3.1	Location and mounting	Gas line from evaporator to chlorinator to subject chlorinators to less pressure during operation.
6.3.2	Stem	Hestalloy ‘C’/Monel
6.4	Spring range	0-10 Kg/cm2.
6.5	Flange	Ends shall be flanged and flange sealing shall be done by lead gasket.
6.5	Body Test Pressure	60 Kg/cm2.
7.0	**CHLORINATOR**	
7.1	Nos and Capacity	Four (4) Nos. @ 150 kg/hr.
7.2	Type	Vacuum solution feed type. Each Chlorinator Cabinet shall be fibreglass, self coloured, resistant to corrosion by chlorine gas and chlorinated water solution.
7.3	Location	Indoor
7.4	Chlorine feed rate adjuster (manual)	Shall be provided.
7.4.1	Design Code	IS: 10553 Part 2
7.5	**MATERIAL OF CONSTRUCTION OF MAJOR COMPONENTS:**	
7.5.1	Vacuum Stabilizing valve	
7.5.1.1	Number	1 No.
7.5.1.2	Type	Diaphram Type

7.5.1.3	Body	PVC
7.5.1.4	Diaphragm	PTFE
7.5.1.5	Plug	Silver
7.5.1.6	Seat	PTFE
7.5.1.7	Spring	Hastealloy 'C'
7.5.1.8	Trim & Fastener	Monel
7.6	**Flow rate valve**	
7.6.1	Number	1 No.
7.6.2	Type	Manual, Borosilicate glass rotameter
7.6.3	Plug	Silver
7.6.4	Body	PVC
7.6.5	Seat	PTFE
7.6.6	Spring/ 'O' ring	Hastealloy 'C'.
7.6.1	**Pressure relief valve**	
7.6.1.1	Number	1 no.
7.6.1.2	Type	Spring loaded type
7.6.1.3	Body	PVC
7.6.1.4	Loading Bolt	PVC
7.6.1.5	Seat	PTFE
7.6.1.6	Spring	Hastealloy 'C'
7.6.1.7	Trim & Fasteners	Monel
7.6.1.8	'O' Ring	Viton
7.6.2	Vacuum regulating valve	
7.6.2.1	Number/unit	1 No./unit with each set
7.6.2.2	Type	Diaphram Type
7.6.2.3	Body	Ebonite
7.6.2.4	Diaphragm and seat	PTFE
7.6.2.5	Spring	Hastealloy 'C'
7.6.2.6	Trim	Monel
7.6.2.7	Fasteners	Monel
7.6.3	**Ejector with inbuilt check valve**	
7.6.3.1	Number/unit	1 no./unit
7.6.3.2	Type	Fixed type
7.6.3.3	Body	CI with FRP lining inside

7.6.3.4	Jet and throat	EBONITE
7.6.3.5	Fasteners	SS 304
7.6.3.6	Gasket	Neoprene rubber
7.6.3.7	Cabinet	Fibre glass moulded design, steel framed with chlorinated rubber paint / FRP
7.6.4	Porous Filter at gas inlet	
7.6.4.1	Number	1 no.
7.6.4.2	Body	CS SA 105
7.6.4.3	Filter Media	Spun Fiber Glass wool
7.6.5	Vent Piping	
7.6.5.1	Size	Suitable
7.6.5.2	Pressure Standard	10 kg/sq.cm
7.6.5.3	Total length	As required
7.6.5.4	Material	PVC
7.6.6	Drain relief valve	
7.6.6.1	Number/Unit	1 no.
7.6.6.2	Type	Spring loaded type
7.6.6.3	Material	
	I. Body	PVC
	ii. Diaphragm	PTFE
	iii. Spring	Hastealloy 'C'
	iv. Trim & Fasteners/ '0' rings	Monel
8.0	**WATER BOOSTER PUMPS:**	
8.1	Nos.	Four (4) nos.
8.2	Capacity	80m^3/hr. (each)
8.3	Type of pump	Horizontal, Centrifugal Non Clog type.
8.4	Type of casing	Radial split.
8.5	Type of impeller	Semi open, open
8.6	Location	Indoor /At chlorination room
8.7	Material of construction:	
8.7.1	Casing	2.5% Ni CI as per IS-210 FG 260
8.7.2	Shaft	EN 8 as per BS 970
8.7.3	Impeller	SS 316
8.7.4	Impeller ring and casing ring	SS / Leaded Bronze

8.7.5	Stuffing box and gland	CI
8.7.6	Gland packing	Graphite free Teflon.
8.7.7	Base plate	MS, IS 2062
8.7.8	Nut and Bolt	SS 316
8.8	Casing & impeller type	End suction top discharge & closed impeller.
8.9	Range of operation	From 20 % to 120 % of rated capacity.
8.10	Design standard	IS-5120 and IS-5659.
8.11	Rated speed	1500 rpm (max.)
8.12	Noise level for pump	85 db at a distance of 1.0 M
8.13	Service temperature	60 Deg C.
8.14	Range of operation	20-120%.
8.15	Suction Condition	Flooded.
8.16	Suction Strainer	Two Nos. (2X100 %).common for Two pumps. Total-4 Nos.
8.17	Type of Drive	Electric Motor
8.18	Painting for complete set of Pump & Motor	
	a) Primer	Two coats of epoxy zinc phosphate primer. DFT per coat - 30 microns.
	b) Finish paint	Two coats of amine-cured epoxy high build paint. DFT percoat-125 microns.
	c) Shade	As approved by customer/consultant
8.19	Tests and Inspection	
	a) Material Test required	For Casing, Impeller, Shaft and Shaft Sleeve.
	b) Hydro-test	As per IS-5120.
	c) Dynamic Balancing Test	To be provided
8.20	Performance Test	
	a) Test Code	Hydraulic Institute Standard.
	b) Tests to be done for determination of	Head-Capacity Curve, BHP-Capacity Curve and Efficiency-Capacity Curve and NPSH-Capacity Curve.
	c) Test to be carried out	On prototype model at rated speed.
	d) Test for satisfactory operation of pump at site	Required.
9.0	**CHLORINATED WATER DIFFUSER AND MIXING SYSTEM**	
9.1	Location for injection of chlorinated water	CW Pump House Fore-Bay.
9.2	Device for injection of chlorinated water	Diffusers.
9.3	Material of construction	Rubber Lined Perforated Steel Tube /PP Diffusers.
9.4	Number	To meet system requirement
9.5	Dimensions	To maintain 4 to 7 lpm flow at a velocity 3 to 4 m/sec

10.0	**SAFETY & SUPERVISORY INSTRUMENTS:**	
10.1	**Gas Mask and Oxygen Breathing equipment along with Breathing Apparatus**	
10.1.1	Number	Two (2) nos.
10.1.2	Capacity	1 hour minimum.
10.1.3	Accessories to be provided	Full mask, full vision face pieces, flow regulating valves and all other accessories.
10.2	Canister Type Breathing Apparatus	
10.2.1	Number	Two (2) nos.
10.2.2	Type	The moisture content from exhaled air of the User should react with granular chemical in Breathing Apparatus and liberates oxygen. The released Oxygen should enter a breathing bag from which the User can inhale.
10.3	Orthotolidine impregnated leak Detectors	
10.3.1	Number	Sixteen (16) nos.
10.3	Ammonia bottles	
10.3.1	Number	Four (4) nos.
10.3.2	Capacity	500 ml each.
10.3.3	Accessories to be provided	Filled up with commercial grade ammonia solution (26 deg. Be) to detect leakage of chlorine.
10.4	**Moisture Absorbing Breathing Bottles**	
10.4.1	Number	One (1) no. for each Chlorine Ton-Container.
10.4.2	Capacity	Two (2) litres silica gel for each bottle.
10.4.3	Type	The moisture absorber shall be fitted to the connection pipe to the Chlorine Ton-Container, as soon as the container detached from the system. The breather shall absorb the moisture and allow dry air in the system to prevent corrosion of pipes and system.
10.4.4	Material of construction	Glass body.
10.5	Chlorine Residual Test Kit (Calorimetric comparator with DPD tablets)	
10.5.1	Number	Two (2) nos.
10.5.2	Type	Colorimetric Test Comparator
10.5.3	Range	One 0 to 0.5 ppm in steps of 0.05 ppm and second 0.5 to 6 ppm in steps of 0.5 ppm.
10.6	**Chlorine Leak Detector**	
10.6.1	Number	Total Sixteen (16) nos. detectors are provided. (a). Fourteen (14) number in Chlorine Ton container room with two sensors located in ducting connected to hoods. (b). Two number in chlorinators room with two sensors
10.6.2	Type	Electronic type
10.6.3	Alarm	Shall be provided in case of leakage of Chlorine.
10.6.4	Interlock	Shall be provided.
10.7	Emergency Kit	
10.7.1	Number	Two (2) nos.

10.7.2	Accessories to be provided	All accessories shall be provided to seal off Chlorine Ton-Containers.			
10.8	Weather Cock				
10.8.1	Number	One (1) no.			
10.9	**Protective clothing**	1 set			
10.10	**Safety Shower and Eye Wash (Step on type automatic body wash and eye wash facility)**	2 nos.			
	Safety Helmet	Two (2) nos.			
	Goggles	Two (2) nos.			
	Rubber Boots	Two (2) Pairs			
	Gloves	Two (2) nos.			
	Colored Vest	Two (2) nos.			
11.0	**INSTRUMENTATION**	As per P & I Diagram			
12.0	**PIPING:**				
12.1	Chlorine liquid handling pipe:				
	i)Material:				
	a) Tubing	Annealed Cu as per ASTM B 88 Cadmium plated of type 'K'.			
	b) Nipple	Silver coated Cu nipple.			
	ii)Hydro test pressure for tubing	40 Kg/cm2 (g).			
12.2	**Pipe handling chlorine:**				
	MATERIAL OF CONSTRUCTION:	**DRY LIQUID CHLORINE**	**DRY CHLORINE GAS UNDER PRESSURE**	**WET CHLORINE GAS UNDER VACCUME**	**CHLORINE SOLUTION**
12.2.1	Pipes	Carbon Steel to ASTM A 106 Gr B Seamless Sch. 80.	Carbon Steel to ASTM A 106 Gr B Seamless Sch. 80.	UPVC	Rubber Lined (rubber lining 3.0 mm thick as per IS: 4682) ERW Carbon Steel pipe to ASTM A53 Gr. B / IS: 1239 Part- I, Heavy grade.
12.2.2	Fittings	Carbon Steel ASTM A 105 Gr I, 300 rating.	Carbon Steel ASTM A 105 Gr I, 300 rating.	UPVC	UPVC/STEEL WITH 3 MM RL
12.2.3	Flanges	Carbon Steel to ASTM A 105 Gr I, Class 300.	Carbon Steel ASTM A 105 Gr I, 300 rating.	UPVC	--
12.3.4	Service Air	Carbon steel IS: 1239 Part 1(Heavy Grade)			
12.3.5	Instrument Air	Galvanized Steel Pipe to ASTM A 53 Gr. B.			
12.3.6	Caustic solution	Rubber Lined ERW carbon Steel Pipe to ASTM A53 Gr. B/ IS: 1239 Part 1, Heavy Grade.			
12.3	**GAS / LIQUID CHLORINE LINES:**				

12.3.1	**a) Globe valve:**	
12.3.1.1	Type	Rising Stem
12.3.1.2	Body	Cast steel ASTM A-150 or 300 /ASTM A216 WCB
12.3.1.3	Stem	Hastelloy C/Monel ASTM B164 / ASTM A4 M-35-1 or M-35-2/ ASTM A 216 type
12.3.1.4	Seat	Monel as per ASTM B164 /ASTMA494 M-35-1- or M-35-2/ TEFLON / PTFE.
12.3.1.5	PACKING	PTFE inpregnated asbestos/TEFLON
12.3.1.6	FITTINGS	Flanged to ANSI B 16.5 class 150
12.3.1.7	DESIGN code	IS- 3224
12.3.2	b) **BALL VALVE:**	
12.3.2.1	Design code	IS-3224
12.3.2.2	Body	Cast steel ASTM A216 Gr WCB / Equivalent
12.3.2.3	Ball	Monel ASTM B-164 / Hastalloy 'C'
12.3.2.4	Stem	ASTM A 216 type 316 /Monel as per ASTM B164 /ASTM A 494 M-35-1- or M-35-2.
12.4	**WATER SERVICE:**	
12.4.1	**GLOBE VALVE:**	
12.4.1.1	Design Code	IS- 780 PN - 1
12.4.1.2	Body	IS-210 FG 260
12.4.1.3	Trim	As recommended by IS-780
12.4.1.4	Fittings Flanged:	ANSI B16.5 Class 150
12.4.2	**GATE VALVE:**	
12.4.2.1	Body	IS-210 FG 260
12.4.2.2	Steam	IS-780 PN-1
12.4.2.3	Seat ring	IS-780 PN-1
12.4.2.4	Fittings	Flanged ANSI B 16.5 class 150
12.4.3	**NON RETURN VALVE:**	
12.4.3.1	Design code	IS-5312 Pt I
12.4.3.2	Body	IS-210 FG 260
12.4.3.3	Disc	IS-5312 Pt I.
12.4.4	**BUTTERFLY VALVE**	
12.4.4.1	Body	CI To IS 210 FG 260
12.4.4.2	DISC	SGI
12.4.4.3	SEAT	EPDM
12.5	**CHLORINE SOLUTION LINE**	

12.5.1	**BUTTERFLY VALVES**	
12.5.1.1	Body	CIRL
12.5.1.2	Disc	EPDM
12.6	**CAUSTIC SOLUTION LINE**	
12.6.1	**DIAPHRAGM VALVE**	
12.6.1.1	Body	CIRL
12.6.1.2	Diaphragm	PTFE
13.0	**CHLORINE ABSORPTION SYSTEM:**	
13.1	Type/Location	Packed counter-current absorption system/Out door.
13.2	Capacity to tonner max.	1000 kg of chlorine
13.3	Designed for leak rateat any time	One tonner at one time
13.4	Absorption capacity of absorbent for one filling	About 1000 kg of chlorine in one hour +20%.
13.5	**CAUSTIC SOLUTION PREPARATION CUM RECIRCULATION TANK:**	
13.5.1	Numbers	One (1).
13.5.2	Type	Vertical cylindrical with flat bottom.
13.5.3	Type of fluid to be handled	20% w/w (maximum) caustic solution. at operating temperature 80 deg C maximum.
13.5.4	Effective capacity, in m3	Adequate for absorption of chlorine leaked from one (1) nos. completely filled Chlorine Ton Containers plus 20% margin or minimum 12 m3.
13.5.5	Minimum Free Board, in mm	300.
13.5.6	Design Pressure, Kg/cm2.g	As per system requirement.
13.5.7	Material of Construction	Body – Carbon – Steel as per IS 2062 or A 515 Gr. 70 with rubber lining. Dissolving basket –SS: 316.
13.5.8	Agitator along with drive motor and other accessories	Agitator shall be motor driven through reduction gear. All wetted parts of the agitator shall be of SS-316 construction.
13.5.9	Instruments	As per system requirement.
13.5.10	Platform complete with handrails for operation	
13.5.11	Staircase	From finished ground level to top of Operation Platform.
13.6	**BLOWERS:**	
13.6.1	Number	Two (2) [1W+1S].
13.6.2.	Location	Outdoor.
13.6.3	Fluid to be handled	Chlorine Gas leaked from Chlorine Ton Container.
13.6.4	Service	To transfer with Chlorine Gas leaked from Chlorine Ton Container to Chlorine Absorption Tower.
13.6.5	Duty	Intermittent.
13.6.6	Type of Blower	Centrifugal.
13.6.7	Type of Impeller	Fan Blade.
13.6.8	Service temperature, in 0C	60 maximum.

13.6.9	Rated Capacity	Adequate for absorption of chlorine leaked from one (1) no. completely filled Chlorine Ton Container, within one hour (maximum).
13.6.10	Head to be developed at rated capacity	As per system requirement and shall be decided during detailed engineering.
13.6.11	Material of construction	
13.6.11.1	Casing	PP/FRP.
13.6.11.2	Impeller	PP/FRP
13.6.11.3	Shaft	EN-8 to BS-970.
13.6.11.5	Coupling Guard	Carbon Steel.
13.6.11.6	Nuts and bolts	Haste Alloy –C
13.6.11.7	Type of Drive	Electric type
13.6.11.8	Base frame	MS as per IS 2062
13.6.12	Testing	As per approved QAP /Performance test as per IS-4894
13.6.13	Rated speed (RPM)	1500 (Sync.) maximum.
13.6.14	Accessories to be provided	Common Base Frame, Suction Filter, Suction Silencer, Discharge Silencer, Discharge Damper.
13.7	**CHLORINE GAS DUCT:**	
13.7.1	Material of construction	FRP-NP-6-Class
13.7.2	Nature of fluid	Mixture of Cl2 gas and air
13.7.3	Pressure rating	Suitable
13.8	**ABSORBENT:**	
13.8.1	Chemicals	Sodium hydroxide
13.8.2	Concentration	NaOH, / 20%
13.9	**RECIRCULATION PUMP FOR CAUSTIC SOLUTION:**	
13.9.1	Type & Qty	Horizontal Centrifugal & Two (2) nos.
13.9.2	Fluid handled	20% w/w (maximum) caustic solution at operating temp. 80 Deg. C max.
13.9.3	Location	Outdoor.
13.9.4	Service	To absorb chlorine leaked from Chlorine Ton Containers.
13.9.5	Duty	Intermittent.
13.9.6	Type of Pump	Horizontal Centrifugal Non Clog type
13.9.7	Type of Impeller	Semi Open or Open
13.9.8	Design standard	As per IS-5639 & IS-5120.
13.9.9	Service temperature, in Deg C.	80 maximum.
13.9.10	Rated Capacity, in m3/hr	Suitable for absorption of chlorine leaked from one completely filled Chlorine Ton Container, within one hour (maximum) plus 20% margin.
13.9.11	Range of operation	20 % - 120 %.
13.9.12	Head to be developed at rated capacity	Each pump to have adequate head to meet the requirements of chlorine absorption system.

13.9.12	**Material of construction**	
13.9.12.1	Casing	Polypropylene
13.9.12.2	Impeller	Polypropylene.
13.9.12.3	Shaft	EN-8 to BS-970/SS 316
13.9.12.4	Mechanical Seal	SS-316.
13.9.12.5	Common Base plate	MS as per IS 2062.
13.9.12.6	Nuts and bolts	SS-316.
13.9.12.7	Type of drive	Electrical Motor
13.9.12.8	Type of coupling between Pump & Motor	Flexible Spacer.
13.9.12.9	Rated speed (RPM)	1500 (Sync.) maximum.
13.10	**EXHAUST FANS**	
13.10.1	Number	As per system requirement and shall be decided during detailed engineering.
13.10.2	Standby Fan	One (1) no.
13.10.3	Description for each Fan	
13.10.4	Location	Indoor
13.10.5	Fluid to be handled	Ambient Air mixed with chlorine gas.
13.10.6	Type	Bifurcated type.
13.10.7	Rated Capacity	As per system requirement.
13.10.8	Head to be developed at rated capacity	As per system requirement.
13.10.9	Material of construction	Polypropylene or FRP.
13.10.10	Type of drive	Electrical Motor
13.10.11	Rated speed (RPM)	1500 (Sync.) maximum.
13.10.12	Accessories to be provided	Each Exhaust Fan shall be provided with motorized damper. The complete electrical wiring and interlock facility shall be provided for both Exhaust Fans as well as Atmospheric Ventilation Fans.
13.11	**CHLORINE ABSORPTION TOWER**	
13.11.1	Numbers To be provided	One (1).
13.11.2	Type	Vertical Cylindrical Packed Absorption Tower. The Absorption Tower shall be mounted on the Caustic Solution Preparation cum Recirculation Tank (described hereinafter).
13.11.3	Type of fluid to be handled	20% w/w (maximum) caustic solution and chlorine gas.
13.11.4	Rated Absorption Capacity, kg of chlorine/hr	Adequate for absorption of chlorine leaked from one (1) no. completely filled Chlorine Ton Container within one hour (maximum).
13.11.5	Caustic Flow Rate, m3/hr	Adequate for absorption of chlorine leaked from one (1) no. Completely filled Chlorine Ton Container within one hour (maximum).
13.11.6	Cl_2 content at outlet of Chlorine Absorption Tower	Free residual chlorine shall not be more than 0.1 ppm.
13.11.7	Size	As per system requirement and shall be decided during detailed engineering.
13.11.8	Material of Construction	FRP

13.11.9	Fill	Polypropylene Raschig/Pall rings along with baffle plates to keep entrainment loss less than 0.1% of circulating liquid flow rate.
13.11.10	Instruments	As per system requirement.
13.11.11	Location	The absorber shall be mounted on the caustic solution preparation-cum-recirculation tank.
	Rain protection	Necessary arrangement in order to prevent rain water entry needs to be provided
14.0	**TONERS STORAGE AREA**	Shall be provided for 18 tonners storage capacity and the area shall be three sides open.(i.e upto 2.0 meter brick wall over which RCC Jali to be provide and indicated.)
15.0	**LIFTING AND HANDLING DEVICES**	
15.1	Monorail hoist	
15.1.1	Number	One (1) no.
15.1.2	Type	Electrically operated.
15.1.3	Duty	To handle Chlorine Ton-Container.
15.1.4	Safe working load	3000 kg maximum.
15.2	**Weighting Scale**	
15.2.1	Number	One (1) no.
15.2.2	Type	Platform Dial Type.
15.2.3	Duty	To handle Chlorine Ton-Container.
15.2.4	Range	0 - 3000 kg.
16.0	**CHLORINE EQUIPMENT ACCESSORIES**	
16.1	**Residual Chlorine Analysers (Range: 0 to 5 ppm)**	One(1) No.
16.2	Location	CW pump discharge to Chlorination plant inlet line.

DATA SHEET-A FOR RW CHLORINATION

SL NO.	PARTICULARS	DESCRIPTIONS
1.0	CAPICITY OF PLANT	2 Nos @ 10 Kg. /Hr.
2.0	DOSING	
2.1	Continuous	5.0 ppm
3.0	TON CONTAINER	
3.1	Type	Ton container
3.2	Nos.	08. (02 nos connected + 06 nos. spare in storage)
3.3	Capacity	Not less than 900 Kg.
3.4	Size	
3.4.1	Overall length	2085 mm (approx)
3.4.2	Diameter	760 mm (approx)
3.4.3	Test pressure	30 kg/cm2 (g)
3.4.4	Design code	ASME Sec VIII/BS-1500 Pt-1
3.5	Material of construction	ASTM-A-285 Gr.C / ASTM A 515 Gr. 70
3.6	Design pressure / temperature	19.9 Kg./Cm2 (g) / 65 deg C
3.7	Corrosion allowance	1.5 mm (minimum).
3.8	Radiography	100 %
3.9	Heat treatment	Fully stress relieved
3.10	Mounting	Each Chlorine container mounted on two nos. metallic brackets, each provided with two roller supports. These brackets will be mounted on civil foundation and all necessary anchor bolts, inserts, nuts etc. shall be furnished by the chlorination plant supplier.
3.11	Applicable code	Design, fabrication and testing to conform to the regulations of Chief Controller of Explosive. Govt. of India / Chlorination Institute, U.S.A.
3.12	CONTAINER VALVES	One set for each container as per IS-3224 & BS-341 or approved equivalent.
3.12.1	EDUCTOR TUBES	
3.12..1.1	NUMBERS	Two (2) nos. eductor pipes shall be provided for each chlorine toner, terminating into a isolation valve.
3.12.1.2	PURPOSE	One eductor tube will be used for chlorine gas withdrawal while the other shall deliver liquid chlorine.
3.12.1.3	CHANGEOVER MODULE	One (1) chlorine automatic changeover facility with manifolds, valves, instruments & fittings.
5.0	CHLORINE GAS STRAINERS	
5.1	Number	Two (2) for each Chlorinator (Total= 4 nos) .
5.2	Capacity	100 % for each Chlorinator.
5.3	Material of construction	Carbon steel SA 105
5.4	Filter Media	Spun Fibre Glass Wool

6.0	**PRESSURE REGULATING VALVE**	
6.1	Number	One (1) for each stream.
6.1.1	Type	Spring loaded silver diaphragm..
6.2	Material of construction	
6.2.1	Body	Carbon Steel as per ASTM A 105.
6.2.2	Diaphragm	PTFE.
6.2.3	Trim	Monel.
6.3	Size	Suitable
6.3.1	Location and mounting	Gas line from tonner to chlorinator to subject chlorinators to less pressure during operation.
6.3.2	Stem	Hestalloy 'C'/Monel
6.4	Spring range	0-10 Kg/cm2.
6.5	Flange	Ends shall be flanged and flange sealing shall be done by lead gasket.
6.5	Body Test Pressure	60 Kg/cm2.
7.0	**CHLORINATOR**	
7.1	Nos and Capacity	Two (2) Nos. @ 10 kg/hr.
7.2	Type	Vacuum solution feed type. Each Chlorinator Cabinet shall be fibreglass, self-coloured, resistant to corrosion by chlorine gas and chlorinated water solution.
7.3	Location	Indoor
7.4	Chlorine feed rate adjuster (manual)	Shall be provided.
7.4.1	Design Code	IS: 10553 Part 2
7.5	**MATERIAL OF CONSTRUCTION OF MAJOR COMPONENTS:**	
7.5.1	Vacuum Stabilizing valve	
7.5.1.1	Number	1 No.
7.5.1.2	Type	Diaphram Type
7.5.1.3	Body	PVC
7.5.1.4	Diaphragm	PTFE
7.5.1.5	Plug	Silver
7.5.1.6	Seat	PTFE
7.5.1.7	Spring	Hastealloy 'C'
7.5.1.8	Trim & Fastener	Monel
7.6	**Flow rate valve**	
7.6.1	Type	Manual, Borosilicate glass rotameter
7.6.2	Number	1 No.

7.6.3	Plug	Silver
7.6.4	Body	PVC
7.6.5	Seat	PTFE
7.6.6	Spring/ 'O' ring	Hastealloy 'C'.
7.6.1	**Pressure relief valve**	
7.6.1.1	Number	1 no.
7.6.1.2	Type	Spring loaded type
7.6.1.3	Body	PVC
7.6.1.4	Loading Bolt	PVC
7.6.1.5	Seat	PTFE
7.6.1.6	Spring	Hastealloy 'C'
7.6.1.7	Trim & Fasteners	Monel
7.6.1.8	'O' Ring	Viton
7.6.2	Vacuum regulating valve	
7.6.2.1	Number/unit	1 No./unit with each set
7.6.2.2	Type	Diaphram Type
7.6.2.2	Body	Ebonite
7.6.2.3	Diaphragm and seat	PTFE
7.6.2.4	Spring	Hastealloy 'C'
7.6.2.5	Trim	Monel
7.6.2.6	Fasteners	Monel
7.6.3	**Ejector with inbuilt check valve**	
7.6.3.1	Number/unit	1 no./unit
7.6.3.2	Type	Fixed type
7.6.3.3	Body	CI with FRP lining inside
7.6.3.4	Jet and throat	EBONITE
7.6.3.5	Fasteners	SS 304
7.6.3.6	Gasket	Neoprene rubber
7.6.3.7	Cabinet	Fibre glass moulded design, steel framed with chlorinated rubber paint / FRP
7.6.3.8	Porous Filter at gas inlet	
7.6.3.8.1	Number	1 no.
7.6.3.9	Body	CS SA 105
7.6.3.10	Filter Media	Spun fibre Glass wool

8.0	**WATER BOOSTER PUMPS:**	
8.1	Nos.	Two (02) nos.
8.2	Capacity	5m^3/hr. (each)
8.3	Type of pump	Horizontal, Centrifugal Non Clog type.
8.4	Type of casing	Radial split.
8.5	Type of impeller	Semi open, open
8.6	Location	Indoor /At chlorination room
8.7	Material of construction:	
8.7.1	Casing	2.5% Ni CI as per IS-210 FG 260
8.7.2	Shaft	EN 8 as per BS 970
8.7.3	Impeller	SS 316
8.7.4	Impeller ring and casing ring	SS / Leaded Bronze
8.7.5	Stuffing box and gland	CI
8.7.6	Gland packing	Graphite free Teflon.
8.7.7	Base plate	MS, IS 2062
8.7.8	Nut and Bolt	SS 316
8.8	Casing & impeller type	End suction top discharge & closed impeller.
8.9	Range of operation	From 20 % to 120 % of rated capacity.
8.10	Design standard	IS-5120 and IS-5659.
8.11	Rated speed	1500 rpm (max.)
8.12	Noise level for pump	85 db at a distance of 1.0 M
8.13	Service temperature	60 Deg C.
8.14	Range of operation	20-120%.
8.15	Suction Condition	Flooded.
8.16	Suction Strainer	Two Nos. (2X100 %).
8.17	Type of Drive	Electric Motor
9.0	**CHLORINATED WATER DIFFUSER AND MIXING SYSTEM**	
9.1	Location for injection of chlorinated water	Stilling chamber of Pre-treatment Plant.
9.2	Device for injection of chlorinated water	Diffusers.
9.3	Material of construction	Rubber Lined Perforated Steel Tube /UPVC Diffusers.
9.4	Dimensions	To maintain 4 to 7 lpm flow at a velocity 3 to 4 m/sec
10.0	**SAFETY & SUPERVISORY INSTRUMENTS:**	
10.1	**Gas Mask and Oxygen Breathing equipment along with Breathing Apparatus**	

10.1.1	Number	Two (2) nos.
10.1.2	Capacity	1 hour minimum.
10.1.3	Accessories to be provided	Full mask, full vision face pieces, flow regulating valves and all other accessories.
10.2	Canister Type Breathing Apparatus	
10.2.1	Number	Two (2) nos.
10.2.2	Type	The moisture content from exhaled air of the User should react with granular chemical in Breathing Apparatus and liberates oxygen. The released Oxygen should enter a breathing bag from which the User can inhale.
10.3	Orthotolidine impregnated leak Detectors	
10.3.1	Number	Three (03) nos.
10.3	Ammonia bottles	
10.3.1	Number	Four (4) nos.
10.3.2	Capacity	500 ml each.
10.3.3	Accessories to be provided	Filled up with commercial grade ammonia solution (26 deg. Be) to detect leakage of chlorine.
10.4	**Moisture Absorbing Breathing Bottles**	
10.4.1	Number	One (1) no. for each Chlorine Ton-Container.
10.4.2	Capacity	Two (2) litres silica gel for each bottle.
10.4.3	Type	The moisture absorber shall be fitted to the connection pipe to the Chlorine Ton-Container, as soon as the container detached from the system. The breather shall absorb the moisture and allow dry air in the system to prevent corrosion of pipes and system.
10.4.4	Material of construction	Glass body.
10.5	Chlorine Residual Test Kit (Calorimetric comparator with DPD tablets)	
10.5.1	Number	Two (2) nos.
10.5.2	Type	Colorimetric Test Comparator
10.5.3	Range	One 0 to 0.5 ppm in steps of 0.05 ppm and second 0.5 to 6 ppm in steps of 0.5 ppm.
10.6	**Chlorine Leak Detector**	
10.6.1	Number	Total Three (03) nos. detectors are provided. (a). Two (02) number in Chlorine Ton container room with two sensors located in ducting connected to hoods. (b). One number in chlorinators room with two sensors
10.6.2	Type	Electronic type
10.6.3	Alarm	Shall be provided in case of leakage of Chlorine.
10.6.4	Interlock	Shall be provided.
10.7	Emergency Kit	
10.7.1	Number	Two (2) nos.
10.7.2	Accessories to be provided	All accessories shall be provided to seal off Chlorine Ton-Containers.
10.8	Weather Cock	

10.8.1	Number	One (1) no.		
10.9	**Protective clothing**	1 set		
10.10	**Safety Shower and Eye Wash (Step on type automatic body wash and eye wash facility)**	2 nos.		
	Safety Helmet	Two (2) nos.		
	Goggles	Two (2) nos.		
	Rubber Boots	Two (2) Pairs		
	Gloves	Two (2) nos.		
	Colored Vest	Two (2) nos.		
11.0	**INSTRUMENTATION**	As per P & I Diagram		
12.0	**PIPING:**			
12.1	Chlorine liquid handling pipe:			
	i)Material:			
	a) Tubing	Annealed Cu as per ASTM B 88 Cadmium plated of type 'K'.		
	b) Nipple	Silver coated Cu nipple.		
	ii)Hydro test pressure for tubing	40 Kg/cm2 (g).		
12.2	**Pipe handling chlorine:**			
	MATERIAL OF CONSTRUCTION:	**DRY CHLORINE GAS UNDER PRESSURE**	**WET CHLORINE GAS UNDER VACCUME**	**CHLORINE SOLUTION**
12.2.1	Pipes	Carbon Steel to ASTM A 106 Gr B Seamless Sch. 80.	UPVC	Rubber Lined (rubber lining 3.0 mm thick as per IS: 4682) ERW Carbon Steel pipe to ASTM A53 Gr. B / IS: 1239 Part- I, Heavy grade.
12.2.2	Fittings	Carbon Steel ASTM A 105 Gr I, 300 rating.	UPVC	UPVC/STEEL WITH 3 MM RL
12.2.3	Flanges	Carbon Steel ASTM A 105 Gr I, 300 rating.	UPVC	--
12.3.4	Service Air	Carbon steel IS: 1239 Part 1(Heavy Grade)		
12.3.5	Instrument Air	Galvanized Steel Pipe to ASTM A 53 Gr. B.		
12.3.6	Caustic solution	Rubber Lined ERW carbon Steel Pipe to ASTM A53 Gr. B/ IS: 1239 Part 1, Heavy Grade.		
12.3	**GAS / LIQUID CHLORINE LINES:**			
12.3.1	**a) Globe valve:**			
12.3.1.1	Body	Cast steel ASTM A-150 or 300 /ASTM A216 WCB		
12.3.1.2	Stem	Hastelloy C/Monel ASTM B164 / ASTM A4 M-35-1 or M-35-2/ ASTM A 216 type		
12.3.1.3	Seat	Monel as per ASTM B164 /ASTMA494 M-35-1- or M-35-2/ TEFLON / PTFE.		
12.3.1.4	PACKING	PTFE inpregnated asbestos/TEFLON		

12.3.1.5	FITTINGS	Flanged to ANSI B 16.5 class 150
12.3.1.6	DESIGN code	IS- 3224
12.3.2	b) **BALL VALVE:**	
12.3.2.1	Design code	IS-3224
12.3.2.2	Body	Cast steel ASTM A216 Gr WCB / Equivalent
12.3.2.3	Ball	Monel ASTM B-164 / Hastalloy 'C'
12.3.2.4	Stem	ASTM A 216 type 316 /Monel as per ASTM B164 /ASTM A 494 M-35-1-or M-35-2.
12.4	**WATER SERVICE:**	
12.4.1	**GLOBE VALVE:**	
12.4.1.1	Design Code	IS- 780 PN - 1
12.4.1.2	Body	IS-210 FG 260
12.4.1.3	Trim	As recommended by IS-780
12.4.1.4	Fittings Flanged:	ANSI B16.5 Class 150
12.4.2	**GATE VALVE:**	
12.4.2.1	Body	IS-210 FG 260
12.4.2.2	Steam	IS-780 PN-1
12.4.2.3	Seat ring	IS-780 PN-1
12.4.2.4	Fittings	Flanged ANSI B 16.5 class 150
12.4.3	**NON RETURN VALVE:**	
12.4.3.1	Design code	IS-5312 Pt I
12.4.3.2	Body	IS-210 FG 260
12.4.3.3	Disc	IS-5312 Pt I.
12.4.4	**BUTTERFLY VALVE**	
12.4.4.1	Body	CI To IS 210 FG 260
12.4.4.2	DISC	SGI
12.4.4.3	SEAT	EPDM
12.5	**CHLORINE SOLUTION LINE**	
12.5.1	**BUTTERFLY VALVES**	
12.5.1.1	Body	CIRL
12.5.1.2	Disc	EPDM
12.6	**CAUSTIC SOLUTION LINE**	
12.6.1	**DIAPHRAGM VALVE**	
12.6.1.1	Body	CIRL

12.6.1.2	Diaphragm	PTFE
13.0	**CHLORINE ABSORPTION SYSTEM:**	
13.1	Type/Location	Packed counter-current absorption system/Out door.
13.2	Capacity to tonner max.	1000 kg of chlorine
13.3	Designed for leak rateat any time	One tonner at one time
13.4	Absorption capacity of absorbent for one filling	About 1000 kg of chlorine in one hour +20%.
13.5	**CAUSTIC SOLUTION PREPARATION CUM RECIRCULATION TANK:**	
13.5.1	Numbers	One (1).
13.5.2	Type	Vertical cylindrical with flat bottom.
13.5.3	Type of fluid to be handled	20% w/w (maximum) caustic solution. at operating temperature 80 deg C maximum.
13.5.4	Effective capacity, in m3	Adequate for absorption of chlorine leaked from one (1) nos. completely filled Chlorine Ton Containers plus 20% margin or minimum 12 m3.
13.5.5	Minimum Free Board, in mm	300.
13.5.6	Design Pressure, Kg/cm2.g	As per system requirement.
13.5.7	Material of Construction	Body – Carbon – Steel as per IS 2062 or A 515 Gr. 70 with rubber lining. Dissolving basket –SS: 316.
13.5.8	Agitator along with drive motor and other accessories	Agitator shall be motor driven through reduction gear. All wetted parts of the agitator shall be of SS-316 construction.
13.5.9	Instruments	As per system requirement.
13.5.10	Staircase	From finished ground level to top of Operation Platform.
13.6	**BLOWERS:**	
13.6.1	Number	Two (2) [1W+1S].
13.6.2.	Location	Outdoor.
13.6.3	Fluid to be handled	Chlorine Gas leaked from Chlorine Ton Container.
13.6.4	Service	To transfer with Chlorine Gas leaked from Chlorine Ton Container to Chlorine Absorption Tower.
13.6.5	Duty	Intermittent.
13.6.6	Type of Blower	Centrifugal.
13.6.7	Type of Impeller	Fan Blade.
13.6.8	Service temperature, in 0C	60 maximum.
13.6.9	Rated Capacity	Adequate for absorption of chlorine leaked from one (1) no. completely filled Chlorine Ton Container, within one hour (maximum).
13.6.10	Head to be developed at rated capacity	As per system requirement and shall be decided during detailed engineering.
13.6.11	Material of construction	
13.6.11.1	Casing	PP/FRP.
13.6.11.2	Impeller	PP/FRP
13.6.11.3	Shaft	EN-8 to BS-970.

13.6.11.5	Coupling Guard	Carbon Steel.
13.6.11.6	Nuts and bolts	Haste Alloy –C
13.6.11.7	Type of Drive	Electric type
13.6.11.8	Base frame	MS as per IS 2062
13.6.12	Testing	As per approved QAP /Performance test as per IS-4894
13.6.13	Rated speed (RPM)	1500 (Sync.) maximum.
13.6.14	Accessories to be provided	Common Base Frame, Suction Filter, Suction Silencer, Discharge Silencer, Discharge Damper.
13.7	**CHLORINE GAS DUCT:**	
13.7.1	Material of construction	FRP-NP-6-Class
13.7.2	Nature of fluid	Mixture of Cl2 gas and air
13.7.3	Pressure rating	Suitable
13.8	**ABSORBENT:**	
13.8.1	Chemicals	Sodium hydroxide
13.8.2	Concentration	NaOH / 20%
13.9	**RECIRCULATION PUMP FOR CAUSTIC SOLUTION:**	
13.9.1	Type & Qty	Horizontal Centrifugal & Two (2) nos.
13.9.2	Fluid handled	20% w/w (maximum) caustic solution at operating temp. 80 Deg. C max.
13.9.3	Location	Outdoor.
13.9.4	Service	To absorb chlorine leaked from Chlorine Ton Containers.
13.9.5	Duty	Intermittent.
13.9.6	Type of Pump	Horizontal Centrifugal Non Clog type
13.9.7	Type of Impeller	Semi Open or Open
13.9.8	Design standard	As per IS-5639 & IS-5120.
13.9.9	Service temperature, in Deg C.	80 maximum.
13.9.10	Rated Capacity, in m3/hr	Suitable for absorption of chlorine leaked from one completely filled Chlorine Ton Container, within one hour (maximum) plus 20% margin.
13.9.11	Range of operation	20 % - 120 %.
13.9.12	Head to be developed at rated capacity	Each pump to have adequate head to meet the requirements of chlorine absorption system.
13.9.13	**Material of construction**	
13.9.12.1	Casing	Polypropylene
13.9.12.2	Impeller	Polypropylene.
13.9.12.3	Shaft	EN-8 to BS-970/SS 316
13.9.12.4	Mechanical Seal	SS-316.
13.9.12.5	Common Base plate	MS as per IS 2062.

13.9.12.6	Nuts and bolts	SS-316.
13.9.12.7	Type of drive	Electrical Motor
13.10	**EXHAUST FANS**	
13.10.1	Number	As per system requirement and shall be decided during detailed engineering.
13.10.2	Standby Fan	One (1) no.
13.10.3	Description for each Fan	
13.10.4	Location	Indoor
13.10.5	Fluid to be handled	Ambient Air mixed with chlorine gas.
13.10.6	Type	Bifurcated type.
13.10.7	Rated Capacity	As per system requirement.
13.10.8	Head to be developed at rated capacity	As per system requirement.
13.10.9	Material of construction	Polypropylene or FRP.
13.10.10	Type of drive	Electrical Motor
13.10.11	Rated speed (RPM)	1500 (Sync.) maximum.
13.10.11.1	Accessories to be provided	Each Exhaust Fan shall be provided with motorized damper. The complete electrical wiring and interlock facility shall be provided for both Exhaust Fans as well as Atmospheric Ventilation Fans.
13.12	**CHLORINE ABSORPTION TOWER**	
13.12.1	Numbers To be provided	One (1).
13.12.2	Type	Vertical Cylindrical Packed Absorption Tower. The Absorption Tower shall be mounted on the Caustic Solution Preparation cum Recirculation Tank (described hereinafter).
13.12.3	Type of fluid to be handled	20% w/w (maximum) caustic solution and chlorine gas.
13.12.4	Rated Absorption Capacity, kg of chlorine/hr	Adequate for absorption of chlorine leaked from one (1) no. completely filled Chlorine Ton Container within one hour (maximum).
13.12.5	Caustic Flow Rate, m3/hr	Adequate for absorption of chlorine leaked from one (1) no. Completely filled Chlorine Ton Container within one hour (maximum).
13.12.6	Cl_2 content at outlet of Chlorine Absorption Tower	Free residual chlorine shall not be more than 0.1 ppm.
13.12.7	Size	As per system requirement and shall be decided during detailed engineering.
13.12.8	Material of Construction	FRP
13.12.9	Fill	Polypropylene Raschig/Pall rings along with baffle plates to keep entrainment loss less than 0.1% of circulating liquid flow rate.
13.12.10	Instruments	As per system requirement.
13.12.11	Location	The absorber shall be mounted on the caustic solution preparation-cum-recirculation tank.
	Rain protection	Necessary arrangement in order to prevent rain water entry needs to be provided
14.0	**TONERS STORAGE AREA**	Shall be provided for 18 tonners storage capacity and the area shall be three sides open. .(i.e upto 2.0 meter brick wall over which RCC Jali to be provide and indicated.)
15.0	**LIFTING AND HANDLING DEVICES**	
15.1	Monorail hoist	

15.1.1	Number	One (1) no.
15.1.2	Type	Electrically operated.
15.1.3	Duty	To handle Chlorine Ton-Container.
15.1.4	Safe working load	3000 kg maximum.
15.2	**Weighting Scale**	
15.2.1	Number	One (1) no.
15.2.2	Type	Platform Dial Type.
15.2.3	Duty	To handle Chlorine Ton-Container.
15.2.4	Range	0 - 3000 kg.

SECTION: C 2

CUSTOMER SPECIFICATIONS

SECTION: C 2A

CUSTOMER SPECIFICATIONS
TECHNICAL REQUIREMENT

(NIL)

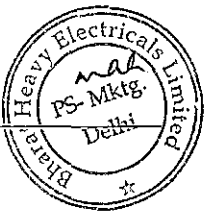
SECTION: C 2B

CUSTOMER SPECIFICATIONS
TECHNICAL REQUIREMENT
(PROJECT SPECIFIC)

VOLUME : IIA

SECTION-IV

GENERAL TECHNICAL REQUIREMENTS



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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.

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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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.

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.

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.

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

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.

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.

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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/Nm^3 (with worst coal and one field out).

b) NO_x - 365 ppm Max. or 750 mg/Nm^3 (Equivalent NO_2).

c) SO_2 - Concentration based standard 2000 mg/Nm^3 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 SO_2 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.

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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
	60 heads	60

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.

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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

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 asphalting 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 building/facility	As per the Tariff Advisory 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

	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	
1.	Horizontal, in all directions	
a)	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
b)	Adjacent to any other plant facilities (including walls/structures)	1000 mm
2.	Vertical (head-room clearance)	
a)	Under any pipe/equipment surface of temperature exceeding 60°C and any electrical cables or other electrical items.	2.0 Metre
b)	Under any other plant facilities (including structures, pipes etc.)	2.0 Metre

	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.

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.	Yes
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 :	
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.
1.0	GENERAL	1
2.0	SCOPE OF WORK	1
3.0	INSURANCE	2
4.0	WORK AT SITE	3
5.0	MANUFACTURER'S SUPERVISION	3
6.0	CONTRACTOR'S REPRESENTATIVE	4
7.0	FOREIGN PERSONNEL	4
8.0	PROGRAMME OF WORK AND PROGRESS REPORT	4
9.0	INDEMNITY	5
10.0	CLEAN UP WORK AT SITE	5
11.0	CO-ORDINATION WITH THE OWNER'S ENGINEERS	5
12.0	MATERIALS HANDLING AND STORAGE	5
13.0	LABOUR AND LABOUR LAWS	6
14.0	PROTECTION AND CARE OF WORKS	8
15.0	OWNERSHIP OF ARTICLES OF VALUE DISCOVERED AT SITE	8
16.0	CONVENIENCE OF PUBLIC	8
17.0	PREVENTION OF EXTRAORDINARY TRAFFIC AND PROTECTION OF HIGHWAY	9
18.0	WORK MATERIALS AND PLANT	9
19.0	ERECTION/CONSTRUCTION TOOLS, TACKLES AND MACHINERY	10
20.0	URGENT REPAIR WORK	10

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.

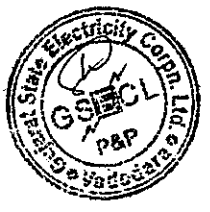
The Work at Site shall be carried out without interference with Owner's activities.

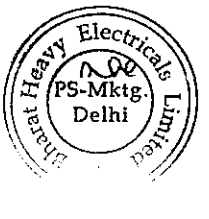
No female labour shall be allowed during dark hours.

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

SECTION-3

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, manufac-turers, 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

[*please insert the date*]:

(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, which ever 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 setforth 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.

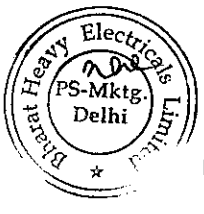
- **"F.O.R. Destination"** shall mean delivery free of expenses to the Owner on board rail wagons at the railway siding at the Site or its nearest railway station including the insurance coverage.

- **"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 I 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, posses, 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.

Provided, the Punch List and pending issues shall not include any items of work, alone or in the aggregate, the non-completion of which prevents the Plant as a whole from (a) being used for its intended purposes as described in the Contract in accordance with Applicable Laws and Applicable Permits or (b) being legally, safely and reliably placed in commercial operation

- "**QA Programme**" shall mean the comprehensive quality control and quality assurance programme to be followed by the Contractor in executing the Supplies, Construction/ Erection of the Works.

- "**Risk Transfer Date**" shall, subject to the obligation of the Contractor including, without limitation, in relation to the Performance Guarantee Test (and consequences of failure thereof including rejection) and Warranty, mean the date on which the Owner assumes the care and custody of the Equipment/Plant or the Plant enters in to Commercial Operation whichever is earlier.

- "**Schedule**" shall mean collectively all the schedules including Project Schedule, Milestone Schedule and other schedules pertaining to the work and the Plant as detailed in the Contract.

- "**Specifications**" or "**EPC Specification**" or "**Technical Specification**" shall mean collectively, the description of the scope, the Owner's requirements, design criteria, technical requirements, Final Proposal, drawings, programme of work Project Schedule, all Appendices to the contract, Appendices to these General Conditions of contract, Performance Guarantees, all terms and stipulations of the contract, and such amendments and revisions, as may be made in the Tender Documents or to the contract and all written agreements made after the execution of the contract by the Parties, or which may pertain to the method and manner of performing the work under the contract as agreed.

- "**Sub-contractor**" shall mean any Person (other than the Contractor or the Owner) to whom any part of the Works has been sub-contracted by the Contractor in accordance with the Contract and with prior approval of the Owner, or with whom the Contractor has entered into any contract for the supply of any Equipment in connection with the Works and with prior approval of the Owner, and shall include its legal successors in title or permitted assigns, and unless otherwise stated, all the Sub-contractors and suppliers to such Person and the term Sub-Contract shall be construed accordingly.

- "**Supplies**" shall mean the supply of the Equipment and the Mandatory Spares by the Contractor in connection with the performance of its obligations under the Contract, including all incidental activities thereto,

- "**Site**" shall mean the land and other places including existing roads and paths put at the disposal of the Contractor by the Owner in connection with the execution of the Contract.

- **"Synchronisation"** shall mean electrical connection of the Plant to the Grid by means of the Interconnection Facility for the first time where the Plant and the Grid are matched in voltage, phase and frequency, after satisfactory Commissioning.

- **"Take Over"** or **"Taking Over"** shall mean taking-over of the whole Plant by the Owner for the purpose envisaged under the Contract after Commercial Operation Date and after successful completion of Performance Guarantee Tests complete within three months from the Commercial Operation of the Plant and successful completion of Tests Before Take Over, as well as liquidation and completion of pending items specified in Punch List in pursuant of the Contract.

- "**Temporary Works**" shall mean all temporary works of every kind (other than Contractor's Equipment) required for the execution and completion of the Works and the remedying of any defects.

- "**Tender Documents**" shall mean the documents for Invitation to Bid together with all amendments thereto and clarifications, if any, issued by the Owner or the Consultant from time to time in respect thereof.

- "**Tests before Commercial Operation**" shall mean in relation to the Plant, all tests prescribed in the Specification and any other tests agreed between the Owner and Contractor to be undertaken by the Contractor.

- **"Tests before Take Over" shall mean** the tests prescribed in the 'Specification', and any other such tests as may be agreed between the Owner and Contractor or instructed as a Change Order, which has to be carried out by the Contractor before the Plant is Taken Over.

- "**Tonne**" shall mean 1,000 Kilogram weight.

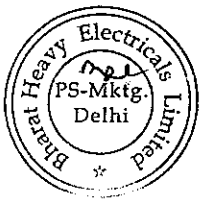
- "**Transmission Facilities**" shall mean all of the facilities to be located off the Site and to be constructed by or for the GETCO to connect the Interconnection Facilities to the Grid.

- "**Reliability Run Test**" or "**Trial Run**" of the Plant shall mean the -Period of 14 days of continuous operation after Synchronization, or extended period thereof if any as more particularly defined at Vol-II A/S-10/CL2.02.02 .

- **"Tests on Completion"** shall mean such tests as are prescribed in the Specifications and/or other tests as mutually agreed upon by the Owner and the Contractor to be carried out by the Contractor to prove satisfactory performance of the Works.

- "**Ton**", shall mean 1,000 Kilogram weight, "Gallon" shall mean Imperial gallon, unless otherwise mentioned specifically.

- "**Unexpected Archaeological Condition**" shall mean uncovering or revealing of an unknown historical or archaeological site at or contiguous to the Site during performance of the Contract that was not



shown or indicated in the Subsurface Investigation and which Contractor could not have reasonably been expected to be aware of.

- **"Unpriced Technical Bid"** shall mean the unpriced technical bid submitted by the Successful Bidder as part of its Final Proposal

- "**Variation**" shall mean alterations, amendments, omissions, additions, or variations of the Equipment or the Supplies as agreed.

- "**Warranty**" shall mean all guarantees and warranties provided or agreed to be provided under the Contract for and in respect of the equipment, work, components, materials, Supplies and parts and works forming part of or incorporated in the Plant or relating thereto supplied or provided by the Contractor and shall include any guarantee or warranty provided or furnished by a sub-Contractor under a sub-contract.

- **Warranty Engineer**" shall mean, the engineer deputed by the Contractor and staying at site, to be responsible for looking after / supervising Operation and Maintenance practices during warranty period.

- "**Week**" shall mean a continuous period of seven (7) Days.

- "**Wilful Misconduct**" shall mean that the Contractor has intentionally concealed the defect in full knowledge of the serious consequences that may flow from its existence and the defect is one, which the Owner could not have discovered on careful examination of the Plant at the time of commencement of Commercial Operation or during the Warranty Period.

- "**Work**" or "**Works**" shall mean the works and services involving engineering, procurement, Supplies, construction, installation, erection, Commissioning of the Plant and shall include all Permanent Works comprised in or forming part of the Plant and the temporary works or either of them as appropriate, and any other works required to be performed by the Contractor under the Contract.

- "**Warranty Period**" shall have the meaning assigned to the term under Clause 21.2 of the GCC, during which the Contractor shall bear all cost covering repair and/or replacement of any defective part of the Plant/ Equipment supplied, works done and services rendered under the Contract.

2.2 Interpretation of Bid Document

1) General Conditions shall be read in conjunction with Instructions to Bidders, special Conditions, Technical Specifications, Drawings and other documents forming part of the Bid Document wherever permissible or the context so requires.

2) Notwithstanding the sub-division of the Bid Document into sections and volumes, every part of each shall be deemed to be supplementary to and complementary of each other.

3) All headings and marginal notes to the items of the General Conditions

or to the Specifications or to any other document forming part of the Bid Document are solely for the purpose of giving a concise indication of the general subject matter thereof and not a summary of the contents thereof and they shall never be deemed to be part thereof or be used in the interpretation or construction thereof.

4) Wherever it is mentioned in the Bid that the Contractor shall perform certain work or provide certain facilities it is understood that the Contractor shall do so at his cost and the price shall be deemed to have included the cost of such performances and provisions so mentioned.

5) The materials, designs and workmanship shall satisfy the applicable standards, specifications contained herein and codes referred to. Where the Bid Document stipulates requirements in addition to those contained in the standards and codes, those additional requirements shall also be satisfied.

6) For the purposes of the Contract including General Conditions of Contract, the expression "legally, safely and reliably placed in commercial operation" shall mean that the Facility, will operate in the manner intended as described in the contract, in accordance with all Applicable Laws and Applicable Permits, and without undue risk of damage or injury to the Plant or Persons.

7) Words incorporating the singular only shall also include the plural and vice -versa where the context requires.

8) "Writing" shall include any manuscript typed or hand-written or printed statement, including E- Mail and facsimile transmission under or over signature or seal as the case may be.

2.3 Priority of documents

For the purpose of interpretation of the Contract, especially in the event of any inconsistency, the following order of precedence shall apply:

Order of Precedence:

The order of precedence shall be the order in which the documents are listed below:

i) The Contract Agreement

ii) Letter of Award duly accepted by the Contractor together with its amendments, if any.

iii) Pre Award Minutes of Meeting, Resolutions to Deviations / Clarifications

iv) Pre-bid clarifications issued by the Owner and Amendments to Tender specifications

v) General Conditions, ITB, Special conditions for erection and Construction

vi) Technical Specifications

vii) Contractor's Bid Proposal

3.0 SCOPE OF WORK

3.1 The scope of work, if not otherwise mentioned in the Contract, shall be on the basis of a single Contractor's responsibility, completely covering all the equipment specified under the accompanying Technical Specifications. The Works include the following: -

a) Detailed design of all the equipment and sub-systems as per Specifications;

b) Complete manufacture of all the Equipment including shop assembly and testing as per Specifications, supply of special tools and tackles and services necessary for satisfactory execution of the Contract;

c) Providing Engineering Drawings, Data and operation manual, etc. for Owner's/Consultant's approval.

d) Packing and transportation of the Goods from the Manufacturer's Works to the Site including freight charges, insurance coverage;

e) Supply of Mandatory Spares;

f) Receipt, unloading, storage, preservation and conservation of the Goods at the Site;

g) Erection, Testing and Commissioning, trial run of all the equipment at the Site, Tests on Completion, putting into Commercial Operation;

h) i) Performance Guarantee Tests on successful completion of Reliability Run

ii) Reliability Test shall commence after completion of Commissioning of the Plant. Length of such operation shall be as specified in [VOL-IIA/S-10/Cl 2.02.02 PAGE 3] of the Contract.

i) Providing construction, erection, testing and commissioning supervision personnel to supervise the work, erection, testing and Commissioning of the Plant;

j) All civil works including supply of all materials and temporary works etc. as needed;

k) Structural work including supply of all materials, Consumables and temporary works etc. as needed;

l) Architectural works as approved by the Owner;

m) Providing three sets of as commissioned Drawings, three sets of as commissioned data/specification/parameter sheets duly signed by the relevant competent authority, and five sets of Compact disks (CDs) should be submitted prior to Take Over.

Provided that all Works shall be done as per the requirements of the Contract including, without limitation, the Drawings and Documents approved by the Owner and the Specifications.

Provided further that the Contractor shall, unless specifically excluded in the Contract, perform all such Work and/or supply all such items and materials not specifically mentioned in the Contract but are required for attaining Commercial Operation of the Plant as if such work and/or items and materials were expressly mentioned in the Contract and in a manner that ensures that the Plant is fit for the purpose intended.

3.2 **STANDARD OF CARE**

The Contractor shall execute and complete the Works in a safe, prudent and reliable manner in strict accordance with the Contract and with Good Engineering Practices.

4.0 **CONTRACT PRICE**

4.1 The Contract Price shall be for the entire scope of the Work with the breakdowns as specified in Schedule of Prices.

The Contract Price shall be lump-sum and firm, and valid for the entire period of the Contract.

4.2 The price for the Goods of origin outside India shall be the CIF Price.

4.3 **Taxes and Duties**

4.3.1 For the Goods of Indian origin, all Taxes shall be deemed to be included in the Contract Price. However excise duty, sales tax, works contract tax, octroi, and similar taxes as payable on finished goods and included in the Contract Price shall be indicated separately considering exemptions which may ordinarily be available/applicable at the prevailing structured rate. Further , Service Tax on Service portion of the Contract will be indicated separately. The normal prevailing rates of aforesaid taxes and duties and exemptions/concessions to the same with concessional rates shall be indicated. In case of delay in delivery not attributable to the Owner, any increase in the rates of aforesaid taxes beyond the scheduled date of delivery shall be to the Contractor's account. The amount of aforesaid taxes paid shall be reimbursed to the Contractor by the Owner upon presentation of documentary evidence upto the limit indicated in the bid offer.

4.3.2 The Taxes and Duties mentioned in Clause 4.3.1 for direct dispatch able items to Site from bidder's Sub Contractors, Sub Vendors , JV Companies whose works are located within India shall be reimbursed by the Owner upon presentation of documentary evidence upto the limit indicated in the bid offer.

4.3.3 In the case where Equipment have been listed under the schedule of items of foreign origin (to be imported) and such list have been accepted by the Owner, the responsibility of obtaining an import license, taking procedures thereon and payment of Taxes will rest with the Contractor though technically Owner will remain as an Importer. The Contractor shall prepare all required documents for

the Owner to make application for such import license and extend all possible assistance to the Owner for expeditious clearance of the license as and when requested by the Owner. The Contractor shall also arrange for payment of Taxes against any consignment on behalf of the Owner and the amount paid towards Taxes will be reimbursed by the Owner to the Contractor in Indian Rupee on presentation of documentary evidence as per Contract. In the case of delay in delivery not attributable to the Owner, any increase in the Taxes, port handling and port clearing charges as well burden due to rise in foreign exchange rate shall be to the Contractor's account.

The Bidder is to furnish a detailed list of imported equipment and materials and quantities against each item along with his Bid.

4.3.4 In the case of raw materials, components, sub-assemblies and other equipment and materials imported by the Indian Contractor for value addition, construction materials and Consumables, if any, all such import duties and levies payable shall be deemed to have been included in the Contract Price and no separate claim on this behalf will be entertained by the Owner.

4.3.5 Additionally, the Contractor shall bear and shall be liable for the payment of its Personal Taxes.

4.3.6 The Contractor and all its expatriate personnel shall be responsible for the timely and prompt filing of all returns, documents, estimates, accounts, information and details complete and accurate in all respects as may be required under the applicable laws/regulations of India by the appropriate authorities in India. In case the Contractor or any of its expatriate personnel do not comply with the above requirements, which results in any penalty, interest or other liability, the same shall be borne by the Contractor.

4.3.7 GSECL will arrange C Forms as applicable on quarterly basis. Also TDS certificate will be issued on quarterly basis.

4.3.8 Taxes and duties in the proposal shall be the rates prevailing fifteen (15) days prior to the date of opening of Techno Commercial Bid.

4.4 Price Adjustment for Quantity Variation in the Works and Change Order

4.4.1 Quantities of Equipment required by the Specification may be in certain cases, subject to variation pursuant to the Change Order in accordance with the procedure set out in this Clause 4.4.

4.4.2 Changes

(i) Owner shall have the right at any time by written notice to Contractor to make changes to the Work, whether such changes are modifications, alterations, deletions or additions. Contractor agrees to effect such changes in the Work as Owner may from time to time request subject to mutual agreement. The Change Order shall be limited within +/- 15% of Total Contract Price.

(ii) Any request by Owner for a change shall be delivered to Contractor in writing and shall be sufficiently definite and detailed to give Contractor an adequate basis on which to prepare a preliminary change order pursuant to Clause 4.4.3.

(iii) Upon receipt of Owner's request for a change, Contractor shall prepare a preliminary change order and deliver the same to Owner within ten (10) days time or any reasonable time mutually agreed following Contractor's receipt of such request.

(iv) Throughout the performance of the Works Contractor shall have a continuing obligation to suggest to Owner for Owner's consideration:

(a) All such changes as Contractor considers desirable; and

(b) Such other changes known to Contractor as may be necessary to incorporate significant new developments in technology which are applicable or appropriate to the Plant.

(c) Contractor shall submit any such suggestion in the form of a preliminary change order pursuant to Article 4.4.3.

4.4.3 Preliminary Change Orders

(i) Each preliminary change order submitted by Contractor to Owner pursuant to Clause 4.4.2 or any other express provision of the Contract shall be in writing and be accompanied by such information and data as will be reasonably required by Owner to evaluate properly the proposed execution of the work in question, the effect, if any, on the Work, scope of Work, 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 the Contract.

(ii) Owner shall reject or approve at its sole discretion each preliminary change order as expeditiously as proper consideration of the nature of the change may reasonably permit.

(iii) The cost of all work involved in preparing the information and data required to accompany the preliminary change order involved and for any additional analytical or investigative work requested by Owner in connection therewith is included in the Contract Price.

4.4.4 Change Orders

(i) Except as provided in Clause 4.4.5, Contractor shall not act upon any preliminary change order unless the Owner has executed a written Change Order.

(ii) Any adjustment of the Contract Price pursuant to the Change Order shall take into account, among other things, the elimination or avoidance of Work to be performed resulting from the changes in the Work and from assistance given by Owner.

4.4.5 Performance of Change Order pending agreement

If Owner and Contractor fail to agree on the effect of a Change Order and as a result a Change Order is not executed, Owner may nevertheless require Contractor to perform the Work as changed by delivering to Contractor a Change Order signed by Owner and Contractor shall complete all work specified in such Change Order and the dispute shall be resolved as provided in Clause 39:

The Owner shall pay to the Contractor in accordance with the Contract, such amount as has been ascertained by Owner as payable for such Change Order pending the resolution of the dispute. Contractor's performance of the Work as changed shall not prejudice either party's position regarding the effects of such change.

4.4.6 Variations in Contract Price

Except as otherwise provided in the Contract any increase or reduction of the Contract Price resulting from any Change Order shall be for the account of Owner, provided that no increase in the Contract Price shall be granted with respect to a change if:

(1) The providing of the additional services is necessary in order for Contractor to satisfy its responsibility to make the Plant operable and capable of performing as contemplated under the Contract and to ensure that the Plant when completed and the Work is performed in accordance with the Contract;

(2) The additional services are required because of delays attributable to Contractor, to late deliveries of Equipment or Contractor's Equipment or to labour shortages or relate to any rectification or remedy of defects or deficiencies required under the Contract;

(3) The additional services are required because of a breach of any of the Guaranteed Commercial Operation Date and Performance Guarantees or Warranties under the Contract; or

(4) The change relates to re-performance of any of the Work because of Contractor's failure to follow Owner's Specifications.

It is clarified that any adjustments in the Contract Price shall be made only in accordance with this Clause 4.4.

4.4.7 Not Considered Changes

Without prejudice to any other provision of the Contract, the following shall not be considered under any circumstances as changes in or within the Work, nor shall any of the following be taken into account when calculating the effect upon the Contract Price of changes in or within the Work nor shall any of the following of themselves be considered the basis for any adjustment of the Contract Price:

(1) Any escalation in the cost of Equipment or labour;
(2) Any increase in manpower hourly rates;
(3) Currency fluctuations in respect of costs included within the Contract Price; and
(4) Any change in the sourcing of Equipment.

4.4.8 The Work shall be subject to further detailing by the Parties from time to time and that, such detailing shall not be considered as a change in Work. In addition, a request by Owner that Contractor perform services or provide Equipment or Contractor's Equipment not specifically included within the Scope of Work shall not be considered a request for a change in the Work if it is required to make the Plant operable and capable of performing as specified in the Contract.

5.0 **TIME : THE ESSENCE OF CONTRACT**

The time and date of completion of the Work as stipulated in the Contract Document and the Guaranteed Commercial Operation Date shall be deemed to be the essence of the Contract. The Contractor shall so organize his resources and perform so as to complete the Work not later than the aforesaid date.

The Contractor shall submit a PERT network showing various key phases of the Work such as design, procurement, manufacturing, shipment, and field erection and construction activities within thirty (30) days after the date of receipt of Notice to Proceed. This network where applicable shall indicate the interface facilities to be provided by the Owner and the dates by which such facilities are needed by the Contractor and also the programme for phase wise release of Work Site for erection work as may be needed by Contractor.

The Contractor shall discuss the network so submitted with the Owner and the same shall be finalized pursuant to such discussions. The agreed network may be in the form as submitted or in revised form in line with the outcome of discussions and shall form part of the Contract Document.

The above PERT network shall be reviewed and periodic review reports shall be submitted by the Contractor to the Owner as directed by him.

The Contractor shall make available to the Owner detailed manufacturing, delivery, erection, testing and commissioning programmes in line with the agreed PERT network in the form of PERT or Bar Chart as desired by the Owner within ninety (90) days from the date of receipt of Notice to Proceed. During performance of the Contract, such programmes shall be renewed, updated and submitted to the Owner as and when needed by him or periodically as specified by him. If in the opinion of the Owner/Engineer proper progress is not maintained, suitable changes shall be made in the Contractor's operation to ensure proper progress.

5.0A **TRANSFER OF TITLE AND RISK**

5.0A1 The legal title (but not risk which shall be transferred on the Risk Transfer Date) of the Equipment dispatched from any country outside India, shall be passed on to the Owner on the point of embarkation. However, the physical possession of such goods will remain in the hands of the Contractor for performance of the balance Scope of Work. The Contractor shall submit, in such form and within such time as required by the Owner, an indemnity bond indemnifying the Owner from any loss or damage to the equipment/material for the period between point and embarkation and the Taking Over the Plant by the Owner.

The transfer of title of goods shall take place when the goods in deliverable country/state are placed on board vessel for onward transmission to the Owner. The clean Bill of Lading issued by the Master of the Vessel shall be indicative of such deliverable country/state. Risk shall however continue to be that of the Consignor/Contractor upto the Taking Over of the Plant.

5.0A2 The Contractor shall remain responsible for, and shall bear the risk of loss or damage to, the Equipment in its possession and the Plant from the Commencement Date until the Risk Transfer Date. Provided that the transfer of risk shall be without prejudice to the obligation of the Contractor under the Contract.

6.0 **PERFORMANCE BANK GUARANTEE FOR DUE PERFORMANCE OF THE WORK**

6.1 The Contractor, upon receipt of Notice to Proceed from Owner shall furnish a Performance Bank Guarantee in the form specified as per Annexure-D as the performance security, for an amount equal to 17.5% of the total Contract Price under the Contract for diligent and due fulfillment by the Contractor of all obligations under the terms and conditions of the Contract. The initial Performance Bank Guarantee of 17.5% will be permitted to be reduced to 10% on completion of Reliability Run, completion of Performance Guarantee Test, and /payment of liquidated damages,(if applicable) whichever is later.

6.2 The Performance Bank Guarantee shall be liable to be invoked towards and claims and/or damages due to the Owner for failure of the Contractor to meet his obligations under the Contract. The Bank Guarantee shall be valid until it is released at the end of Warranty Period as stipulated in Clause 21 of this Section.

6.3 However, the amount of the Performance Bank Guarantee, after expiry of the Warranty Period, may be reduced in proportion to the Work released from Warranty obligations at the discretion of the Owner.

The Performance Bank Guarantee amount in case of divisible Contract shall be 17.5% of the total value of the Contract for the faithful performance of the Contract in accordance with the Contract Document. The guarantee amount shall be payable to the Owner in the currency of the consideration of the Contract without any condition whatsoever and their Guarantee shall be irrevocable.

6.4 In addition to the grounds specified above, The Performance Bank Guarantee is shall be liable to be invoked in the event:

a) The Owner has obtained an award in arbitration and the amount awarded has not been paid within thirty (30) days after the award, or

b) The Contractor has gone into liquidation or has been declared bankrupt, or

c) Any other reason which may adversely affect the contractual obligations of the Contractor.

Performance Guarantee is intended to secure the satisfactory performance by the Contractor of the entire Contract.

7.0 **SUPPLY, ERECTION CONTRACT/DIVISIBLE CONTRACT**

Notwithstanding anything stated elsewhere in the Bid Document, the Contract to be awarded is on the basis of Supply- Erection Contract (Divisible Contract) with single point responsibility. In the mode of contracting on the basis of Supply-Erection, the supply portion of the Contract will relate to the supply of the Plant and the erection portion will relate to port clearance, port handling, inland transportation, insurance, storage, unloading, erection, construction, testing, commissioning, Engineering, Project Management etc. as will be defined in the Contract Document.

In the case of a divisible contract, the title of ownership of Goods to be supplied

shall pass on to the Owner on dispatch Ex-works/F.O.B. However, until the Work is completed in all respects and the Plant is taken over by the Owner, the Goods shall remain within the custody of the Contractor. The above arrangement shall not in any way dilute the responsibility of the Contractor for the successful commissioning of the Plant and completion of other works as per Bid Specifications and both the contracts shall contain a cross default clause, namely, that a breach of one contract shall automatically be classified as a breach of the other contract, which will confer a right on the Owner to levy LD from other contractor and to terminate also the other contract as well at the risk and cost of the Contractor.

8.0 TERMS OF PAYMENT

8.1 The terms of payment for the price components of the Supplies of Equipment and Mandatory Spares, civil and architectural works, and erection are detailed in the Contract Agreement.

8.1.1 Initial Advance

The advance in accordance with the provisions of Clause 8.4, 8.5, 8.6, 8.7, and 8.8 of these GCC (each of such advance being referred to as "Advance Payment") will be paid on fulfillment of all of the following conditions by the Contractor:

i) Signing of Contract Agreement;(Agreement shall be signed within 45 days from the date of acceptance of LOA)

ii) Submission of an unconditional Performance Security (Performance Bank Guarantee) as per clause -6.0 of the General Conditions;

iii) Submission of an unconditional additional Performance Guarantee /by concerned entity, as prescribed by the Owner;

iv) Submission of a preliminary Project network schedule indicating major milestones based on the Work schedule.

v) Submission of Advance Payment Bank Guarantee as per clause-8.2 below.

Submission of detailed Project Network Schedule shall be made within 45 days from the date of signing of Contract.

8.2 Documentation and Bank Guarantee for Advance Payment

The Contractor shall furnish the following documentation as a condition for making request for Advance Payment.

i) Invoice for amount of Advance Payment in original and five (5) copies.

ii) Bank guarantee in the proforma attached with Volume-1, Section-2, Annexure-I-I for an amount equivalent to the aggregate amount of Advance Payment ("**Advance Payment Bank Guarantee**") with one (1) copy of original bank guarantee valid upto Take Over of Plant issued or counter guaranteed/confirmed by any Indian Nationalized Bank or its foreign branch. The charges for counter guarantee/confirmation, if any, shall be to Contractor's account.

iii) Advance Payment Bank Guarantee for Advance Payment shall be denominated proportionately in currencies of contract or US Dollars.

8.3 **Adjustment of Advance Payment**

The Advance Payment made shall be adjusted against the progress payments, progressively at the same rate of advance i.e., if 10% advance paid, 10% of the invoice value of the progress payment will be adjusted against making progress payment. Upon each such recovery, the value of the Advance Payment Bank Guarantee shall be reduced progressively by the amount of advance so recovered by Owner from Contractor's progress payments. Apportioning the break-up of other payments shall be as further detailed below. All further payments under the Contract shall be made as stipulated in the Contract Agreement. Reduction of Advance Payment Bank Guarantee shall be permitted every six months i.e. January and July of each year based on records available with GSECL.

8.4 **Design Engineering Charges**

Design engineering charges component will be paid as per detailed break-up as setforth in the contract after issue of certification of completion of same by Contractor to Owner and acceptance thereof by Owner/Owner's representative in following installments:

i) 0 to 5% (max 5%) of Design Engineering Charges as Advance Payment on fulfillment of conditions in sub-clauses-8.1 and 8.2

ii) 75% (cumulative not exceeding 80%) of Design Engineering Charges as progress payment on approval of drawings and document – payable in 36 monthly equated installments.

iii) 7% (cumulative not exceeding 87%) of Design Engineering Charges on certification of successful completion of Reliability Run of Plant as per specification by Owner.

iv) 6% (cumulative not exceeding 93%) of Design Engineering Charges on Final Plant Acceptance/Take- Over of Plant and also submission of as built drawings.

v) 7% (cumulative not exceeding 100%) of Design Engineering Charges on Satisfactory completion of warranty period.

Contractor acknowledges that certification or its acceptance by the Owner's representative shall not, however, relieve or absolve in way or manner the Contractor from the performance of work and other obligations under the Contract including Performance Guarantee and Warranty obligations under the Contract.

8.5 **Project Management Charges**

Project Management charges component will be paid as per detailed break-up in following installments:

i) 0-5% (max 5%) of Project Management charges as Advance Payment on fulfillment of conditions in sub-clauses-8.1 and 8.2

ii) 75% (cumulative not exceeding 80%) of Project Management charges on equal monthly installments for the Contract Period.

iii) 7% (cumulative not exceeding 87%) of Project Management Charges on certification of successful completion of Reliability Run of plant as per specification by Owner;

iv) 6% (cumulative not exceeding 93%) of Project Management charges on Take Over of plant.

v) 7% (cumulative not exceeding 100%) of Project Management Charges on Satisfactory completion of warranty period and also submission of as built drawings, O & M manuals etc.

8.6 **Supply Price**

For Supplies of Equipments, the payments shall be linked with the despatch of materials and shall only be made after production of all despatch documents as specified in Letter of credit (L/C) conditions in case of supplies of non Indian origin and / or in the relevant contract conditions which will, inter-alia, include 3 original Bills of Lading in case of CIF supplies and the equipment Material Despatch Clearance Certificate issued by the Owner/Owner's representative after inspection if applicable.

i) Supply price component will be paid as per break-up below:

Item No.	Time of Payment	% Component FOB/Ex-Works Price	Condition to be fulfilled
1.0	Advance Payment	0-5% (max 5%)	As per clauses-8.1 and 8.2 of this General Condition.
2.0	Advance Payment against placement of orders for major equipments.		
a)	Evidence of order placement of all major equipment/system	0-5% (cumulative not exceed 10%)	Evidence of order placement for all major Items to be ordered within first 6 months from zero date as per L1 schedle shall be considered.
b)	Despatch of Equipment/system from Manufacturer's Works	55% (cumulative not exceeding 65%)	Production of invoices and satisfactory evidence of shipment for major orders and submission of Material Despatch Clearance Certificate and Inspection Certificate as per quality assurance program.

Item No.	Time of Payment	% Component FOB/Ex-Works Price	Condition to be fulfilled
3.0	Receipt of equipment /system	15% (cumulative not exceeding 80%)	Verification and certification by the Owner / Owner's representative of the equipment / system received and stored at 'Site'
4.0	Successful Completion of Reliability Run	7% (cumulative not exceeding 87%)	Certification of successful completion of Reliability Run of plant as per contract by Owner.
5.0	Successful completion of Performance tests	6% (cumulative not exceeding 93%)	Take Over of Plant
6.0	Warranty Charges	~~2%~~ 7% (cumulative not exceeding 100%)	Satisfactory completion of Warranty Period and Extended Defects Correction Period, as evidenced by issuance of Defects Liability Certificate, and also submission of O & M manuals, As built drawings etc.

ii) The Ocean Freight and Marine Insurance Charges and the in-land transportation and Marine insurance charges shall be paid to Contractor on pro-rata basis to the FOB price of component shipped on evidence of activities having been carried out. The aggregate of all such pro-rata payment shall not exceed the total amount identified in contract price provided, however, wherever equipment wise above mentioned charges have been identified in contract the payment of such charges shall be based on such charges identified in contract against evidence of activity having been carried out.

8.7 **Erection, testing and Commissioning Price**
(Excluding civil & architectural works)

In case of erection, progress payments shall only be made after the issue of Certificates by the Owner / Owner's representative, as detailed under:

i) 0-5% (max 5%) of total erection, testing and commissioning price as Advance Payment and fulfillment of conditions in sub-clauses -8.1 and 8.2 above and on establishment of site office by the Contractor at site.

ii) 75%(cumulative not exceeding 80%) of the erection, testing and commissioning price will be made as progressive payments against progressive erection on tonnage basis for mechanical and electrical

items and successful completion of quality check points. Separate basis for cabling and instrumentation, which will be finalized between Owner and Contractor prior to contract award. Progress payments shall only be made after the issue of Certificates by the Owner/Owner's representative, one for the quantum of work completed and the other by the Field Quality Surveillance representative for the successful completion of quality check points involved in the quantum of work billed.

iii) 7% (cumulative not exceeding 87%) of the erection, testing and commissioning price on successful completion of Reliability Run of Plant as per contract.

iv) 6% (cumulative not exceeding 93%) of the erection, testing and commissioning price on Take Over of plant.

v) 7% (cumulative not exceeding 100%) of the erection, testing and commissioning price on satisfactory completion of warranty period.

Further break-up of erection activities of the above identified equipment for progressive payments shall be as setforth in Milestone payment schedule.

8.8 **Civil, Structural and Architectural Price**

i) 0-5% (max 5%) of total civil, structural & architectural price as Advance Payment and fulfillment of conditions in sub-clauses 8.1 and 8.2 above and on establishment of site office by the Contractor at site.

ii) 75% (cumulative not exceeding 80%) progressive payment on certification by the Owner/Owner's representative on the basis of the work performed of total civil, structural and architectural price of the package as per the payment stages as setforth in Milestone Payment Schedule.

iii) 7% (cumulative not exceeding 87%) of total civil, structural and architectural price component on successful completion of Reliability Run as per contract.

iv) 6% (cumulative not exceeding 93%) of total civil, structural and architectural price component on Taking Over.

v) 7% (cumulative not exceeding 100%) of the total civil, structural and architectural price component on satisfactory completion of warranty period.

8.9 **Mandatory Spare Price**

i) The FOB Ex-works including packing and forwarding charges price component of Mandatory Spares shall be paid as indicated below:

a) 75% of price component for Mandatory Spares after submission of material despatch clearance and inspection certificate, despatch to Site and submission of requisite shipping documents. An indicative list of the shipping documents is given under Clause 9.3 of these GCC.

b) 25% of price component for Mandatory Spares on receipt and storage at Site and physical verification by the Owner/Owner's Representative.

ii) The ocean freight and marine insurance charges and the inland transportation and insurance charges shall be paid to the Contractor pro-rata to the value of Mandatory Spares received at Site on production of invoices by the Contractor.

iii) Tools and tackles Prices: This shall form part of Supply Price and shall be claimed under supply payment.

Quantity variation in spares: The Purchaser may vary the quantity of mandatory spares to be ordered provided the ordered quantity results in a "whole number" or a "complete set". Order for spares with quantity expressed as a fraction will not be made. Variation in quantities, indicated in percentage or LOT will not be made. However, complete deletion of any item can be made.

8.10 **Not Used**

8.11 **Schedule of Payments**

Based on the terms of payment in clauses mentioned above and work schedule payment of Contract Price component linked with achievement of Milestones shall be paid in accordance with Milestone Payment Schedule. The Milestone payment schedule specifies the installments of Contract Price, and the Milestones to be achieved and the payment thereunder shall be subject to the following:

i) The installments quoted in the Milestone payment Schedule may be modified by Owner / Owner's representative if progress is not as scheduled.

ii) Payment shall be made on the date which is the later of (i) accomplishment of a milestone and (ii) the date fixed for accomplishment of such a milestone as set out in the Milestone Payment Schedule.

iii) Submission of documentation/data to Owner/Owner's representative for approval.

iv) Submission of monthly progress reports and updated Network Schedule

8.12 **Application for Interim Payment Certificates and Claim for Payments**

8.12.1 The Contractor shall submit a statement (the **Interim Payment Certificate**"), in six copies to the Owner/Owner's representative after the end of each month before the tenth day of the next month, in a form approved by the Owner/ Owner's representative, showing the amounts to which the Contractor considers himself to be entitled, together with supporting documents which

shall include the detailed report on the progress during the month. In order to be eligible for payment, the Interim Payment Certificate shall include the following items, as applicable, which shall be expressed in the currencies in which the contract price is payable, in the sequence listed:

i) The estimated contract value of the Design and construction documents produced and the Works executed up to the end of the month (including variations but excluding items described in sub-paragraphs (iv) to (vii) below);

ii) Certification from Owner/Owner's representative that the applicable Work has been performed and that the quality of Work described in the Interim Payment Certificate is in line with contract;

iii) If there is any pending or threatened dispute, regarding Work covered by such request or payment as a result of which Contractor intends to withhold payment from such sub-Contractor, a report detailing such dispute and circumstances thereof;

iv) Any amounts to be added and deducted for which Change Order has been issued;

v) Any amounts to be added and deducted for the Advance Payments and repayments in accordance with clause 8.3 above;

vi) Any other additions or deductions which may have become due in accordance with the Contract including, without limitation, deduction on account of liquidated damages.

vii) The deduction of the amounts certified in all previous Interim Payment Certificates.

viii) Any other information that the Owner/Owner's representative may reasonable request.

8.12.2 Contractor shall raise its consolidated invoices/bills only once a month.

8.13 **Mode of Payment**

8.13.1 For supply of Equipment and Mandatory Spares:

The mode of payment by Owner to the Contractor shall be mutually agreed before finalization of Contract. The same may be by way of establishing an irrevocable Letter of Credit (L/C) in favour of the Contractor through a bank in case of supplies of Non-Indian origin directly to Owner and through a nationalized bank to be nominated by the Contractor in case of Indian Supplies only for payments due on despatch of equipment or by way of direct disbursement of loans. The payment will be made through usance L/C as per credit period of payment specified in the specification. The L/C format will be mutually decided during finalization of Contract.

The value of L/C will be as per payment schedule for each quarter and valid for a quarter. It will be the responsibility of the Contractor to utilize the L/C to the fullest extent. In case L/C has been established by the Owner and not utilized by the Contractor, all reinstatement charges for the L/C for further period necessitated due to non-utilization of L/C will be to the account of the

Contractor.

All L/C charges shall be to Owner's account except L/C charges for confirmation by Contractor's bank which will be borne by the Contractor. For non-Indian supplies, Contractor shall be responsible for all permits, licenses and the like from respective authorities necessary for export of equipment from the respective countries to the Owner.

8.13.2 For Other Payments

The payment of advance(s), price adjustment, any other supply payment, ocean freight, marine insurance, Taxes (wherever admissible), inland transportation (including port handling), insurance, civil and architectural works and for the erection portion of the Works shall be made direct to the Contractor by the Owner.

8.13.3 Unless otherwise agreed by the parties, payments by Owner to Contractor, shall be made in currencies as per Schedule of Prices by cheque to an account or accounts designated by Contractor and maintained by Contractor or by such other person or entity at a bank or banker in Vadodara, Gujarat, India in writing. Extra Work shall be paid in accordance with the applicable Change Order as part of the work under the Contract. Once all acts necessary to initiate the relevant wire transfer have been completed within the time specified for such payments, any delays within the international or domestic banking system in the transfer of such payments to Contractor's account or accounts as aforesaid shall not give rise to a claim that Owner has breached its payment obligations hereunder.

Payment will be made in the respective currencies quoted by the bidder for onshore supply for import content of raw material of onshore supply. Bidder shall have to provide the drawdown schedule in respective currencies & to include in price bid accordingly.

8.13.4 The Owner shall pay the amount certified in each Interim Payment Certificate within 30 days from the date on which the Owner/Owner's representative received the Contractor's statement and supporting documents and the Owner shall pay the amount certified in the Final Payment certificate within 120 days from the date of issue of the Take Over certificate.

8.13.5 Pursuant to this clause-8.0, if the commercial banks are closed due to a public holiday, period as above shall be extended to the first business day after the end of the period concerned. In addition, unless the parties otherwise agree, Owner shall not be obligated to pay, in respect of any request for payment, any amount in excess of 100% of the cumulative amount anticipated to be paid for work completed to such date, as set forth in the projected payment schedule as per Schedule of Prices. If any request for payment does not comply in all material respects with the Contract, Owner shall inform Contractor about the same within 15 days following the receipt of such request for payment, and Contractor shall re-submit such request for payment. If less than the full amount is paid, Owner shall state in writing the reasons for paying such lesser sum. Any dispute regarding Owner's payment of a lesser sum than that set forth in a request for payment must be raised by Contractor within 30 days of receipt of such payment, or Contractor's right to dispute such payment is waived. During the pendency of any such Dispute and the resolution thereof, Contractor shall continue to perform the work in

accordance with the provisions set forth herein.

8.14 **Payments Withheld**

8.14.1 Owner shall have the right to withhold from any payment due to Contractor, including the final payment, such amounts as Owner reasonably deems necessary or appropriate to protect it because of any one or more of the following reasons:

i) Defects in any work, which might affect Owner's ability to operate Unit or Plant as contemplated herein, whether or not payment has been made therefor;

ii) The filing of a any vendor/tradesman's lien or similar encumbrance in respect of the work or the plant (or any portion thereof);

iii) A dispute as to the accuracy or completeness of any request for payment received by Owner pursuant to this clause-8.0 within 90 days of receipt thereof or payment made thereunder;

iv) Contractor's failure to deliver any Performance Securities and additional performance to Owner as in the Contract;

v) Any requirement in accordance with Applicable Laws to withhold any Taxes payable by Contractor in respect of the work or any part thereof; and

vi) Contractor's failure to make payments to sub-Contractors or workers for work, including amounts withheld by Contractor because of disputes between Contractor and such Persons.

8.14.2 In addition to the provisions of this clause-8.0 which relates to the recovery by the Owner of any amounts that the Owner may have paid, for which the Contractor is liable under the contract, the Owner shall also be entitled to recover all the dues in terms of the contract including liquidated damages for delay, liquidated damages for the shortfall in the guaranteed performance parameters, etc by way of deductions from the payments due to the Contractor or that may become due to the Contractor in future or from any securities/guarantees under the contract and/or otherwise.

8.14.3 Notwithstanding any dispute that Contractor may have, and regardless of the basis thereof or grounds there for, Contractor agrees that it will, for so long as the Contract has not been terminated diligently prosecute the Work up to Take over of Plant, all in accordance with the terms of the Contract.

9.0 **SHIPPING PARTICULARS**

9.1 The Contractor shall be responsible for the correct appraisal of freight rates, weights and volumes of structural's or machinery as the case may be. The Owner shall not be liable to pay any warehouse or wharf age charges due to the necessity of storing Goods awaiting shipment.

9.2 All consignments shall be addressed to and the bill of lading and other shipping documents shall be made in the name of the Consignee.

9.3 After shipment is effected, the following documents shall be forwarded to the

Consignee by registered air mail/courier services.

i)	The original bill of lading in duplicate and four (4) non-negotiable copies of the same.	
ii)	F.O.B. invoices	Six (6) copies including one (1) original
iii)	Freight invoice & freight details	Six (6) copies including one (1) original
iv)	Insurance premium receipts or certificates	- Ditto -
v)	Packing list	- Ditto -
vi)	Certificate of origin	Six (6) copies including one (1) original

10.0 DELIVERY TERMS

10.1 When the Goods are ready for shipment, the Owner should be notified by the Contractor through fax or email. Notification of dispatch and delivery in regard to each and every consignment shall be made to the Owner immediately after dispatch and delivery in case of delivery at either the Site or at the port of entry as applicable at least forty-eight (48) hours ahead of actual delivery. The Contractor shall further supply to the Consignee an invoice and packing list of all Goods dispatched or delivered by him and other shipping particulars. All packages, containers, bundles and loose materials forming part of each and every consignment shall be described fully in the packing list, and full details of the contents of packages and quantity of goods shall be submitted to the Owner.

10.2 For the Goods imported by the Contractor, the Contractor shall deliver the Goods at CIF price. The Contractor shall also make all arrangements to deliver the Goods to the location specified in Technical Specifications.

11.0 LIQUIDATED DAMAGES

11.1 Delay

Scheduled dates for Commissioning will be as specified in Schedule [insert] of the Contract. If the Contractor fails to achieve Commissioning within the time fixed thereof, he shall be liable to pay liquidated damages for the delay at the rate of half percent (½%) of the total Contract Price per week of delay. The total amount of liquidated damage on account of delay shall not exceed 10% of the Total Contract Price considering all types of Contracts including supply and erection.

11.2 <u>Failure to meet Performance Guarantees</u>

The liquidated damage for non fulfillment of Performance Guarantees will be as indicated below.

Sl. No.	Item	Value
1.	For increase in each Kcal/KWh of weighted average plant overall heat rate.	Rs. 7.5 Crores
2.	For every KW shortfall in gross power output at generator terminal	Rs. 100,000
3.	For increase in Auxiliary Power Consumption per KW	Rs. 200,000
~~4.~~	~~For every m^3/hr increase in DM water consumption~~	~~Rs. 1 Crore~~

The total amount of liquidated damage for non fulfillment of Performance Guarantee shall be maximum 10% of the Contract Price considering all types of Contracts including supply and erection.

11.3 The total amount of liquidated damages on account of delay in Commissioning and non-fulfillment of Performance Guarantees shall not in any case exceed fifteen percent (15%) of the total Contract Price. The Owner shall deduct the amount of such liquidated damage from any money due or which may become due to the Contractor under the Contract, and/or recover such liquidated damage from the Performance Guarantee of the Contractor. To be entitled to impose the liquidated damage, the Owner will not be required to prove that he has incurred such amount as actual damages.

Liquidated damages to be paid in currency of the Contract Price on Pro-rata basis.

11.4 Rejection

If the total aggregate liquidated damages for short fall in Performance Guarantees of all parameters (shortfall in HR, power output, DM water consumption, Auxiliary Power Consumption) will be higher than 10% of the Contract Price then the Owner may at its option, either,

(a) Reject the Equipment/plant and recover the payments already made

Or

(b) Terminate the Contract pursuant to GCC 24.0 and recover the payments already made,

Or

© Accept the equipment after levy of liquidated damages in accordance with the provisions specified in GCC 11.0 of Contract Agreement.

12.0 SHOP ASSEMBLY AND INSPECTION

12.1 Shop Assembly

Shop Assembly to the largest extent feasible shall be performed by the Contractor to assure proper fitting of the various parts, and for checking the correctness of clearances and dimensions. Parts thus assembled shall be match-marked for reassembly at the Site, prior to dismantling for shipment. A detailed description of the intended shop assemblies shall be submitted along with a quality assurance plan.

12.2 Inspection before Shipment

No Goods shall be shipped before all tests and inspections have been carried out according to the Approved quality assurance plan unless otherwise instructed by the Owner.

The acceptance of any Goods prior to shipment shall in no way relieve the Contractor of any of his responsibilities for meeting all the requirements of the Specification and shall not prevent subsequent rejection if such Goods are found to be defective.

Incase inspection of Equipment/Goods needs visiting foreign countries, cost of 10 man visits shall be considered in the contract..All expenditure including that for travel shall be borne by bidder.

13.0 **CONTRACTOR'S DRAWINGS AND DATA**

13.1 a) The Contractor shall be responsible for developing detailed Drawings to adopt equipment and materials to be supplied to the requirements indicated in the Specification and shall submit a list of such Drawings and a programme for submission of these Drawings and documents within ninety (90) days from the date of receipt of the Notice to Proceed.

b) The Contractor shall also provide the Owner with the following Drawings and documents in the number of copies mentioned in Technical Specifications as per agreed schedule.

i) Technical particulars conforming to the Specifications.

ii) Outline drawings of major equipment together with weights and sufficient overall dimensions.

iii) Other drawings and documents as indicated in the Technical Specifications.

c) The Contractor shall, prior to submitting the Drawings and documents, submit to the Owner two copies of the Codes and Standards other than Indian Standards and Codes which shall govern the Works.

13.2 Copyright in the Owner's requirements and other documents issued by the Owner or the Owner's Representative to the Contractor shall (as between the parties) remain the property of the Owner.

The copyright in all drawings, documents and other materials containing data and information furnished to the Owner by the Contractor herein shall remain vested in the Contractor or, if they are furnished to the Owner directly or through the Contractor by any third party, including suppliers of materials, the copyright in such materials shall remain vested in such third party. The Owner shall however be free to reproduce all drawings, documents and other material furnished to the Owner for the purpose of the Contract including, if required, for operation and maintenance of the Facility

13.3 The Contractor shall indemnify the Owner in case of breach of this clause by the Contractor. If these documents are received by a third party from the Contractor and the third party makes use of these documents detrimental to the

Owner or use these documents for their personal gain, the Contractor shall compensate the Owner for the loss suffered as well as for the value of gain derived by third party.

14.0 MISTAKES IN DRAWINGS

The Contractor shall be responsible for and shall pay for any alterations of the Work due to any discrepancies, errors or omissions in the Drawings or other particulars supplied by him whether such Drawings or particulars have been Approved by the Engineer or not.

15.0 MATERIALS AND WORKMANSHIP FOR MANUFACTURER

All Goods to be supplied and all Works to be done by the Contractor under the Contract shall be manufactured and executed in the manner stipulated in the Specifications.

The Contractor shall use the best available materials for the Works. These materials shall be of recent manufacture, free from defects and imperfections and unused.

The highest standards of safety shall be adhered to during execution of the Works.

16.0 COMPLETENESS OF EQUIPMENT

The equipment supplied shall be complete in all respects. The Contractor shall not be eligible for any extra payment in respect of such mountings, fittings, fixtures and accessories if required for the safe and reliable operation of the equipment.

Parts of all similar equipment supplied shall be interchangeable with one another.

17.0 CERTIFICATE OF THE OWNER

Every application to the Owner for a certificate must be accompanied by a detailed invoice (in quadruplicate) setting forth in order of the schedule of quantities and prices as per Approved billing breakdowns of the Works executed and/or Goods ready for dispatch up to the date of claim. The certificate relating to such Goods and Work as in the reasonable opinion of the Engineer in accordance with the Specifications shall be issued within thirty (30) days of receipt of the application.

The Owner may, with any certificate, make any corrections or modifications to any previous certificates issued by him. The payments to be made against invoices under certification will be regulated and adjusted accordingly.

18.0 OWNER'S DECISION

In respect of all matters which are left to the decision of the Owner, including the granting or withholding of certificates; the Owner shall, if required to do so by the Contractor, give in writing a decision thereon and his reasons for taking such decision. If in the opinion of the Contractor, a decision made by the Owner

is not in acceptance with the meaning and intent of the Contract, the Contractor may file with the Owner within fifteen (15) days after receipt of the decision, a written objection to the decision. Failure to file such an objection within the allotted time will be considered to be acceptance of the Owner's decision and the decision shall become final and binding.

The Owner's decision and the filing of the written objection of the Contractor thereto shall be a condition precedent to the right to request for arbitration. It is the intent of the Contract Agreement that there shall be no delay in the execution of the Work in such cases and the decision of the Owner as given shall be promptly observed.

19.0 CERTIFICATE NOT TO AFFECT THE RIGHT OF THE OWNER OR THE CONTRACTOR

No certificate of the Engineer on account, nor any sum paid on account by the Owner, nor any extension of time for the execution of the Work by the Contractor under the powers granted by item "Certificate of the Owner" shall affect or prejudice the rights of the Owner against the Contractor, or relieve the Contractor of his obligations for the due performance of the Contract or be interpreted as Approval of the Work done or of the Goods supplied. No certificate shall create the liability for the Owner to pay for alterations, amendments, variations or additional work not ordered in writing by the Owner, or discharge the liability of the Contractor for payment of damages, whether due, ascertained or certified or not or of any sum against the payment of which he is bound to indemnify the Owner, nor shall any such certificate nor the acceptance by him or any sum paid on account or otherwise, affect or prejudice the rights of the Owner against the Contractor.

20.0 OWNER ACCEPTANCE AND TAKE OVER CERTIFICATE

In order to achieve Owner acceptance, Contractor must certify to the satisfaction of Owner/Owner's representative that:

i) Reliability Run Test and Performance Guarantee Test have been completed to the satisfaction of Owner.

ii) All punch list and pending issues have been completed in accordance with the contract;

iii) All the Contractor's and sub-Contractor's personnel, supplies, unused materials, waste, rubbish and temporary facilities located at or near such plant have been removed from such location,

iv) All other provisions of and all items required by the Contract have been performed or delivered, as the case may be, in accordance with the Contract and in a manner satisfactory to Owner.

v) Contractor has delivered to Owner a Project Completion certificate certifying satisfactorily completion of each of the conditions set forth in sub-clauses -20(i) to 20(iv) above.

Upon certification by Contractor of satisfactory completion of sub-clauses -20 (i) through 20(iv), Owner shall issue a Take over Certificate certifying such

matters within 60 (Sixty) days

21.0 **WARRANTY**

21.1 The Contractor hereby provides following Warranty in respect of the Equipment to be furnished by the Contractor:

a) All Equipment shall be new and in accordance with the Contract and shall be fit for the intended purposes,

b) All Equipment shall be free from any defect due to faulty design, materials and/or workmanship.

c) The Equipment shall perform satisfactorily and the performance and efficiencies of the specified Equipment shall not be less than the respective guaranteed values.

d) The efficiencies, temperature rise and other performance data of all other Equipment shall be as per the Contract.

e) All other Works including civil, structural and architectural works shall be in accordance with the Contract and free from any defect and omission.

f) The Work will be designed so that the Plant is capable of being operated in a safe, reliable, economic and efficient manner, in accordance with the requirements of the Contract.

The Contractor undertakes to reaffirm the above Warranty, if so required by the Owner, in such forms as prescribed by the Owner and shall be signed by the Contractor and, if so required by the Owner, by Sub-contractor(s) of the Contractor.

If the Contractor finds, after his Tender is accepted, that a variation in work, construction technique or the quality of materials is necessary to fulfill the Warranty called for, such variations may be made with the approval of the Owner, provided the request for changes is made during execution of the contract Agreement and the changes are to be made without any increase in the price.

21.2 The Warranty shall be valid for a period of twelve (12) calendar months commencing from the date of Taking Over of the fully completed Plant at the discretion of the Owner. This period of the Warranty shall be referred to as the **"Warranty Period"**.

21.3 During the Warranty Period, the Contractor's liability shall be limited to the replacement of any defective parts that may develop in Plant, of his own manufacture or those of his associate(s) and Sub-contractor(s) under the conditions provided for by the Contract under proper use and arising from faulty design, materials or workmanship. All such replacements of defective parts mentioned above shall be made free of cost at Site by the Contractor and the return of the defective parts to the Contractor's works shall be the Contractor's responsibility and shall be made at his expense. In the case of these defective parts which are not repairable at Site but are essential, in the Owner's opinion, for the commercial operation of the Plant or the Equipment, the Contractor shall replace at the Site, free of cost of the Owner the said defective parts before the

defective parts are removed to his Works in such a manner which will minimize interruption in the operation of the Plant and/or the Equipment. Provided always that such defective parts as are not repairable at Site, and are not essential in the meantime in the commercial use of the Plant, may be taken by the Contractor to the Contractor's works for repairs unless otherwise arranged. The decision to replace/repair the defective items shall be discussed and mutually agreed at appropriate stage.

21.4 The cost of any special or, general overhaul rendered necessary during Warranty Period due to defects in the Plant or defective Work shall be borne by the Contractor. The Owner will, however, render such assistance in this matter as will expedite the same.

21.5 If for rectification or replacement of any part of equipment or work due to defective materials, manufacture or design or workmanship, the services of the Contractor's personnel are requisitioned within the Warranty Period, these services shall be made available free of any cost to the Owner.

21.6 If it becomes necessary for the Contractor to replace or renew any defective portions of the Plant under this Clause, the provisions of this Clause will apply to the portions of the Plant so replaced or renewed until the expiration of **Extended Defects Correction Period**. Further, the Contractor shall ensure that the Performance Bank Guarantee shall remain outstanding or a replacement on-demand bank guarantee is delivered to the Owner in an amount equal to one hundred percent (100%) of the estimated value of each such item until the Extended Defects Correction Period applicable thereto has expired.

21.7 If any defect be not remedied within a reasonable time, the Owner may proceed to do the work at the Contractor's risk and expenses but without prejudice to any other rights which the Owner may have against the Contractor in respect of such defects.

21.8 If the replacements or renewals are of such character as may affect the efficiency of the Plant, the Owner shall have the right to give to the Contractor within one (1) month of such replacement or renewal, notice in writing that "tests on completion" be made, in which case such tests shall be carried out as provided in Clause on Tests on completion and Trial Run at the Site" in the Technical Specifications. Should such tests show that the Plant sustains the guarantee given in the Contract; the cost of the test shall be borne by the Owner. Should the guarantee be not sustained, the cost of the test shall be borne by the Contractor. Further, all necessary works will be carried out by the Contractor to achieve guarantee given in the contracts and perform tests to prove the same at his own cost.

21.9 Until the final certificate has been issued, the Contractor shall have the right of entry at his own risk and expenses by himself or his duly authorised representatives whose names shall previously have been communicated in writing to the Owner at all reasonable working hours of the Plant and taking notes there from and, if he desires, at his own expenses making any tests, subject to the approval of the Owner that will not be unreasonably withheld.

21.10 The issue of the Taking over Certificate shall in no way exempt the Contractor from the provisions of this Clause 21.

21.11 At the end of the Warranty Period, the liability of the Contractor shall cease

other than in respect of items which are subject to an Extended Defects Correction Period.

21.12 The Contractor shall provide, at the Site, at least one (1) control and instrumentation engineer, one (1) electrical engineer, one (1) mechanical engineer and one (1) operation expert during the Warranty Period without additional cost to the Owner.

21.13 The Contractor agrees that any item of Equipment replaced or rectified during the Warranty Period shall conform to the Technical Specifications of the corresponding original Equipment and if required by the Owner, the Contractor shall demonstrate such conformance through suitable means (to be decided by the Contractor at its sole discretion) including inspection by the Owner, shop testing or operation of the Equipment of which the replaced equipment/material constitutes a part.

21.14 WARRANTY FOR SPARES

In addition to the foregoing, the Contractor warrants that all spares supplied will be new and in accordance with the Contract and will be free from defects in design, material and workmanship and further guarantee as under:

For mandatory spares and two (2) years recommended spares:

For item of spares ordered or to be ordered by the Owner for two (2) years operational requirement of the Plant which are manufactured as a continuous operation together with the corresponding main equipment/ component, the Warranty will be twelve (12) months from the Taking Over of the Plant under the Contract. In case of any failure in the original Equipment due to faulty designs, materials and workmanship, the corresponding spare parts if any, supplied shall be replaced without any extra cost to the Owner unless a joint examination and analysis by the Owner and the Contractor of such spare parts prove that the defect found in the original part that failed can safely be assured not to be present in spare parts. Such replaced spare parts will have the same Warranty as applicable to the replacement made for the defective original part/component.

21.15 Latent Defects:

Notwithstanding the issue of the Take Over Certificate, the Contractor shall be responsible for making good with all possible speed any Latent Defect in any Works /equipment of the plant which appears at any time before the expiry of defect liability period. And shall remedy such defect at its own cost and expense. The latent defect liability period shall be a minimum of 5 years from the end of defect liability period. The defects to which this applies are defects in design, materials or workmanship or defects arising from any act or omission of the Contractor done or omitted prior to Take-over of the portion of the Plant affected by the defects or during the Warranty Period which a reasonable examination at the end of the Warranty Period would not have disclosed.

22.0 DEFAULT OF CONTRACTOR

Termination upon Contractor's bankruptcy or default:

22.1 In the event the Contractor:

(i) Contractor is adjudged a bankrupt or insolvent, or

(ii) Contractor makes a general assignment for the benefit of its creditors, or

(iii) A trustee or receiver is appointed for Contractor or for any of its property, or

(iv) Contractor files a petition to take advantage of any debtor's act, or to reorganize under the bankruptcy or similar laws, or

(v) Contractor fails to supply sufficient skilled workers or suitable materials or Equipment, or fails to commence the Work or abandons the Work or part thereof or fails to rectify any Work done that has been objected or rejected to by the Owner or if it fails to make prompt payments when due to Subcontractors or for labour, materials or equipment, or

(vi) Contractor otherwise commits a material breach of any of the terms of the Contract,

Then Owner may, without prejudice to any other right or remedy Owner may have hereunder or at law or in equity, at any time terminate the Contract upon 30 days' notice to Contractor, provided such event or breach is not remedied within such 30 days period or, if the breach or default cannot reasonably be cured within 30 days, such longer period (not to exceed 90 days) as may be reasonably necessary to cure such breach or default. Owner may terminate the Contract immediately upon notice to Contractor if Contractor disregards a material provision of any Applicable Law. Owner may terminate the Contract, upon 30 days' notice, if Contractor disregards any other provision of Applicable Law, provided any such failure is not remedied within such 30 days period. Contractor shall receive no Termination Payment or other cancellation payments in the event of a termination under this clause, but Contractor shall be entitled to any part of the Contract Price then due and payable for the Works already performed.

23. Not used

24. FORECLOSURE OF CONTRACT

Termination for Owner's Convenience:

Owner may at will for its convenience at any time and without cause, terminate the Contract upon 30 days prior written notice to the Contractor.

Immediately upon receipt of such notice, Contractor shall stop performance of the Works, stop all further sub-contracting or purchasing activity, and terminate Sub-contracts; handover all Documents, equipment, materials and spares relating to the Works prepared by the Contractor or procured from other sources up to the date of termination for which the Contractor has received payment equivalent to the value thereof and shall immediately order & commence demobilization and remove all Contractor's Equipment, which is on Site and repatriate all his staff and labour from the Site.

Consequences of Termination.

24.1 Termination for Contractor's bankruptcy or default under Clause 22

24.1.1 In the case of termination by Owner for default or bankruptcy under the circumstances contemplated by Clause 22, Contractor shall not, pending settlement of Owner's claims by reason of such termination, be entitled to receive any further payment and shall protect, defend, indemnify and hold Owner harmless from and against all Losses arising directly or indirectly from or incurred by reason of such termination and, in any event, Owner shall not be liable to Contractor for any amount of the Contract Price in excess of the percentage of Work actually completed by the termination date multiplied by the Contract Price ("**Work Value**").

24.1.2 In addition, should the aggregate amount of the Contract Price actually paid prior to termination exceed the Work Value, Contractor shall pay to Owner an amount equal to such excess within thirty (30) days after receipt of an invoice from Owner therefor.

24.1.3 Accrued or actual or potential liabilities of Contractor under the Contract, for acts and omissions with respect to Work partially or fully completed at the time of termination shall not be affected by any such termination.

24.1.4 In furtherance of the foregoing, Owner shall have the right (either with or without the use of Contractor's Equipment) to finish the Work itself or with the assistance of third parties and Contractor shall be liable for the excess of the total cost of the Work actually incurred by Owner to all parties, persons or entities over the price for the Work originally contracted for hereunder.

24.1.5 In particular, to complete the Work, Owner shall have the right to take possession of and use, or to permit any third party to use, all Contractor's Equipment on or about the Site which are the property of Contractor. Rent for use of equipment by Owner and indemnification thereof shall be provided by GSECL.

24.1.6 Upon completion of the Work, all such Contractor's Equipment shall be returned to Contractor, subject to the right of Owner (which shall constitute a lien on such Contractor's Equipment) to sell the same and apply the proceeds to any claim which Owner may then have against Contractor.

24.1.7 Owner shall have the right at its sole discretion to select third parties to assist in or undertake such completion of the Work, such selection to be based upon such criteria as Owner shall determine.

24.2 Termination for Owner's Convenience under Clause 24

Upon termination of the Agreement under Clause 24 (for Owner's Convenience), Contractor shall be entitled to be paid:

(a) all actual documented costs incurred by Contractor, as audited and accepted by an independent certified public accounting firm of national reputation selected by Owner and acceptable to Contractor, incurred or that could not be avoided in connection with performance by Contractor